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June 27, 2000

Mr. Anthony Iacobone
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U.S. Environmental Protection Agency
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PROJECT:	Contract No. 68-S7-3003
DOCUMENT NO.:	3230-018-CO-EPOU-00455
SUBJECT:	Work Assignment 018-RICO-03AT Vienna PCE Remedial Investigation/Feasibility Study Final Site Management Plan DCN: 3230-018-PP-SAMP-00456

Dear Mr. Iacobone:

CDM Federal Programs Corporation (CDM Federal) is pleased to submit the enclosed final *Site Management Plan* for the Vienna PCE Site in Vienna, West Virginia. This document is submitted in fulfillment of the deliverable requirements established under Subtasks 1.7 & 1.8 of the project work plan.

If you have any questions or comments, please contact David Schroeder or me at 703-968-0900.

Sincerely,

CDM FEDERAL PROGRAMS CORPORATION

Joan O'Neill Knapp

Joan O. Knapp
Program Manager

cc: J. Herlihy, Jr. RAC III Contracting Officer (letter only)
J. Tralie, RAC III Project Officer (letter only)
D. Schroeder, CDM Federal RAC III Project Manager
Document Control File

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RESPONSE ACTION CONTRACT
FOR REMEDIAL PLANNING AND OVERSIGHT ACTIVITIES
IN EPA REGION III

U.S. EPA CONTRACT NO. 68-S7-3003

FINAL

SITE MANAGEMENT PLAN
FOR
VIENNA PCE
VIENNA, WEST VIRGINIA

PART I - FIELD SAMPLING PLAN
PART II - QUALITY ASSURANCE PROJECT PLAN
PART III - DATA MANAGEMENT PLAN
PART IV - POLLUTION CONTROL AND MITIGATION PLAN

Work Assignment No.: 018-RICO-03AT
Document Control No.: 3230-18-PP-SAMP-00456

June 27, 2000

Prepared for:
U.S. Environmental Protection Agency
Region III
Philadelphia, Pennsylvania

Prepared by:
CDM Federal Programs Corporation
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Fairfax, VA 22033

ORIGINAL (Red)

RESPONSE ACTION CONTRACT
FOR REMEDIAL PLANNING AND OVERSIGHT ACTIVITIES
IN EPA REGION III

U.S. EPA CONTRACT NO. 68-S7-3003

TITLE AND APPROVAL SHEET

FINAL
SITE MANAGEMENT PLAN
FOR
VIENNA PCE
VIENNA, WEST VIRGINIA

Work Assignment No.:018-RICO-03AT

Prepared by: David C. Schroeder Date: 6/27/00
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Anthony Iacobone
Remedial Project Manager
U.S. Environmental Protection Agency

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PART I: FIELD SAMPLING PLAN

1.0 INTRODUCTION

This document serves as CDM Federal Programs Corporation's (CDM Federal's) Site Management Plan (SMP) for Remedial Investigation (RI) and Feasibility Study or Engineering Evaluation and Cost Analysis (FS) activities to be conducted at the Vienna Tetrachloroethylene (PCE) Superfund Site (the Site) located in Vienna, Wood County, West Virginia (Figure 1-1), under the U.S. Environmental Protection Agency (EPA) Region III Response Action Contract (RAC), Work Assignment No. 018-RICO-03AT. This SMP has been prepared to describe all measurement, sample collection, sample handling, and sample shipment procedures to be followed by CDM Federal during RI/FS activities at the site. The SMP includes both a Field Sampling Plan (Part I Sections 1 through 4) and a Quality Assurance Project Plan (Part II Sections 5 through 8). Part III, Section 9.0 provides the Data Management Plan and Part IV, Section 10.0 provides the Pollution Control and Mitigation Plan. The Health and Safety Plan may be found in Appendix C.

1.1 PROJECT OBJECTIVES

The objective of this work assignment is to provide personnel, services, materials, and equipment required to perform RI/FS activities at the site. RI/FS activities include completion of the field investigation, human health and ecological risk assessments, analytical support and data validation to be performed by other EPA contractors, data evaluation, and completion of the FS. The overall goal of the RI/FS is to determine the nature and extent of groundwater contamination at the site and to identify a remedy to eliminate, reduce, or control risks to human health and the environment. The RI portion of the study will focus on collecting adequate data to define the nature and extent of contamination at the site. The Risk Assessment (RA) will evaluate the risk to public health and the environment related to contamination identified during the RI. The FS portion of the study will investigate alternatives which could be implemented to remediate contamination at the site.

The overall objective of the RI is to characterize the nature and extent of groundwater contamination. The proposed scope for the RI field investigation will involve several different activities. Initially, a survey will be conducted to determine whether existing monitoring wells can be used for groundwater monitoring as well as to collect information on water levels in the functional wells. Two Cone Penetrometer Technology (CPT) rigs will then be used to collect groundwater samples to determine the location of up to 30 additional monitoring wells (under consultation with EPA). After consultation with EPA, the proposed wells will be installed, and three rounds of groundwater sampling from the new and existing wells will be completed. CPT groundwater samples will be analyzed for trichloroethene (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene, and trans-1,2-dichloroethene (cis- and trans-1,2-DCE) by a mobile laboratory. All groundwater samples collected from the new and existing monitoring wells will be analyzed by a fixed-base Contract Laboratory Program (CLP) laboratory. After the completion of the first round of groundwater sampling, aquifer tests will be conducted on 15 of the newly installed wells. The test will consist of a falling head slug test.

Using the results of the groundwater sampling, aquifer sampling, and survey results, a Screening-Level Ecological Effects Evaluation will be completed. Dependent on the findings of the ground water investigations and the Screening-Level Ecological Effects Evaluation, a scientific and management decision will be made as to whether a more extensive ecological characterization will be completed. This additional ecological characterization is not expected to be required due to the nature of the contaminant and media and observations made at the site which indicate that the area is a heavily urbanized area with few ecological resources.

If the U.S. Fish and Wildlife Service (USFWS) determines that the site is within the habitat of a federally listed species, CDM Federal will follow approved protocol to survey for the species. The USFWS will provide written notification along with the protocol if a survey is required.

Data collected from the investigation will be used to support a human health risk assessment and provide information for an initial evaluation of appropriate remediation technologies in a feasibility study or an engineering evaluation and cost analysis (EE/CA). The determination regarding whether a feasibility study or EE/CA will be performed will be made by EPA after the first round of groundwater sampling data is available.

All RI/FS activities will be completed in accordance with EPA's *"Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988).* Ecological risk assessment activities completed as part of this RI will follow EPA's *"Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments"* (EPA 1997). The human health risk assessment completed as part of this RI will follow all applicable EPA guidance. Treatability Study activities, if deemed necessary by EPA, will be completed in accordance with the EPA Fact Sheet *Guide for Conducting Treatability Studies Under CERCLA, November, 1993.*

1.2 PROJECT SCHEDULE AND DELIVERABLES

This work assignment was initiated on August 18, 1999. The period of performance (POP) currently ends on September 1, 2001; however, the POP will need to be extended to accommodate the projected schedule. Deliverables for the project and their corresponding due dates will consist of the following:

Estimated Schedule of Project Deliverables	
Draft Work Plan and Cost Estimate *EPA Review*	January 7, 2000 *4 weeks*
Final Work Plan and Cost Estimate	45 days after receipt of EPA comments (deliverable dated February 23, 2000)

Estimated Schedule of Project Deliverables	
Draft Site Management Plan includes: • Health and Safety Plan • Field Sampling Plan • Quality Assurance Project Plan • Data Management Plan • Pollution Control and Mitigation Plan *EPA Review*	45 days after Work Plan approval (deliverable due June 2, 2000) *4 weeks*
Final Site Management Plan	30 days after receipt of comments (deliverable dated June 27, 2000)
DAS Request	2 months prior to Field Event (August 14, 2000, based on Field Event starting on October 16, 2000)
Technical Memorandum - Ecological Reconnaissance	2 weeks after Ecological Reconnaissance (Deliverable due October 2, 2000)
ANSETS Reports	Monthly during Field Events (November 3, December 1, December 29, January 26, 2001)
Data Useability Reports	1 week after receipt of validated data (assumed 4-week TAT for validated data; March 2, 2001, based on data validation completion on February 26, 2001
Technical Letter Report (includes Risk Assessment Plan)	4 weeks from receipt of validated data (Deliverable due March 23, 2001)
Human Health Risk Assessment <u>Interim Deliverables:</u> Standard Table 1 Standard Table 2 Standard Table 3 Standard Table 4 Standard Table 5 Standard Table 6 Standard Table 7 Standard Table 8 Standard Table 9 Standard Table 10	 3 weeks from receipt of validated data (March 16, 2001) 3 weeks from receipt of validated data (March 16, 2001) 12 weeks from receipt of validated data (May 18, 2001) 12 weeks from receipt of validated data (May 18, 2001) 12 weeks from receipt of validated data (May 18, 2001) 12 weeks from receipt of validated data (May 18, 2001) 15 weeks from receipt of validated data (June 8, 2001) 15 weeks from receipt of validated data (June 8, 2001) 15 weeks from receipt of validated data (June 8, 2001) 16 weeks from receipt of validated data (June 15, 2001)

Estimated Schedule of Project Deliverables	
Draft Human Health Risk Assessment *U.S. EPA review* Final Human Health Risk Assessment	3 weeks after submission of Standard Table 10 (July 6, 2001) *4 weeks* 4 weeks from receipt of comments (August 31, 2001)
Screening-Level Problem Formulation and Ecological Effects Evaluation	8 weeks from receipt of validated data (April 20, 2001)
Screening-Level Preliminary Ecological Exposure Estimate and Risk Calculation	8 weeks from receipt of validated data (April 20, 2001)
Ecological Characterization Work Plan *US EPA review/approval*	8 weeks after Technical Meeting (if needed) *4 weeks*
Draft Baseline Ecological Risk Assessment *US EPA review/comments*	8 weeks from Ecological Characterization completion *4 weeks*
Final Baseline Ecological Risk Assessment	6 weeks from receipt of comments
Draft RI Report *US EPA review/comments*	9 weeks from receipt of validated data or 9 weeks from the summary meeting (April 27, 2001) *4 weeks*
Final RI Report	6 weeks from receipt of comments (July 6, 2001)
Treatability Study Work Plan	To be determined
Draft Remedial Alternatives Screening Technical Memorandum *US EPA review/comments*	4 weeks from technical meeting (assumed meeting on March 23, 2001)(April 20, 2001) *4 weeks*
Final Remedial Alternatives Screening Technical Memorandum	4 weeks after receipt of comments (June 15, 2001)
Remedial Alternatives Evaluation	4 weeks days after Final Remedial Alternatives Screening (July 13, 2001)
Draft Feasibility Study or EE/CA *US EPA review/comments*	15 weeks after 3 completion of Final RI (October 19, 2001) *4 weeks*
Final Feasibility Study or EE/CA	4 weeks after receipt of comments (December 14, 2001)
Fact Sheets	To be determined
Work Assignment Close Out Deliverables	10 weeks after receipt of EPA's Work Assignment Closeout Notification

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION AND HISTORY

The city of Vienna, West Virginia, is a residential and commercial community approximately three square miles in area, with a population of 11,000 people (see Figure 1-1). The city is located on the eastern bank of the Ohio River, which flows southward in the vicinity of the Vienna PCE site. North and east of the city is a mountain ridge which ranges from 800 to 900 feet above mean sea level. The city of Parkersburg, West Virginia is immediately south of Vienna. The residents and the majority of businesses in Vienna receive their water from the Vienna municipal water supply, which consists of eight wells located in clusters throughout the city (see Figure 2-1).

The dry cleaning solvent PCE has been detected in six municipal drinking water wells. Within the area to be evaluated, two facilities have been identified as being probable sources of groundwater contamination and are considered to be potential responsible parties (PRPs). Based upon city, state, EPA, and PRP-generated data, the contaminant has been detected at highly elevated levels in surface and subsurface soils at the Vienna Cleaners and Busy Bee Cleaners facilities, in groundwater beneath the vicinity of the cleaners, and in the city sewers in the immediate vicinity of the site.

Vienna Cleaners, an active dry cleaning facility since the late 1940s, is situated about one block from the Vienna City Hall, and is surrounded by private businesses and single family dwellings. Busy Bee Cleaners, set in a similar area, is about three blocks south of City Hall. Dry cleaning operations were performed at the Busy Bee Cleaners location since the 1960s. In 1992, during a State of West Virginia inspection, the Vienna Cleaners property owner stated that past practices at the cleaners included pouring waste PCE onto the ground behind the facility.

PCE contamination was first detected in February 1992 at Municipal Wells 1 through 4, located at City Hall. The highest concentrations of PCE were detected in samples collected from these wells by the city on June 2, 1992; 170, 390, 8, and 7 micrograms per liter (µg/l) were detected in Wells 1 through 4, respectively. The EPA established maximum contaminant level (MCL) for PCE in drinking water is 5 µg/l. The city discontinued use of these wells on June 11, 1992.

Municipal Wells 5 and 6 are located approximately 1000 feet northwest of City Hall, and were removed from service in 1991, due to benzene leaking from an underground storage tank (UST). Groundwater samples collected from these out-of-service wells by the West Virginia Department of Environmental Protection (WVDEP) on September 22 and 24, 1992 had PCE concentrations of 70 µg/l and 0.5 µg/l, respectively. Municipal Wells 7 and 8 are 1,400 feet northwest and hydraulically downgradient of Municipal Wells 5 and 6. The concern for these wells is potential future contamination as a result of being downgradient of Municipal Wells 5 and 6. Traces of toxic metals (chromium, selenium, arsenic, and lead) were also detected at Municipal Wells 9 and 10, which are located approximately 5,800 feet south by southwest of City Hall.

Before 1995, the water supply for the city's residents was entirely derived from the 12 municipal wells located in five clusters throughout the city. No treatment facility for water from other sources was available. With production at six wells discontinued, the city faced a potential water shortage emergency. Consequently, two additional municipal wells (13 and 14) were installed in 1995, hydraulically upgradient from the contaminated areas, to serve as a backup water supply in the event of such an emergency. The two wells were brought online on March 10, 1997 to meet existing demands.

In May 1993 and 1994, EPA Response, Engineering, and Analytical Contract (REAC) personnel completed two phases of investigation at the site. The first phase of the investigation consisted of a soil gas survey to assess the source(s) and extent of contamination in the subsurface. The second phase of the investigation consisted of installing, developing, and sampling four groundwater monitoring wells (ERT-1 through ERT-4) located within the contaminated aquifer. The primary contaminant found at the site was PCE with very few degradation by-products. REAC personnel installed and tested two exploratory wells (ERT-5 and ERT-6) in the area suspected to be free of contamination to evaluate aquifer conditions for subsequent installation of new municipal supply wells.

A PCE plume was detected in soil gas and groundwater extending from just north of the Vienna Cleaners to the south as far as the intersection of Grand Central Avenue and 27th Street (the location of Busy Bee Cleaners). The highest PCE concentrations were found, in both soil gas and groundwater, in the vicinity of the Vienna Cleaners and the Busy Bee Cleaners. The highest PCE groundwater concentrations detected during the 1993 REAC sampling event were from ERT-4 (4,763 µg/l), located adjacent to the Vienna Cleaners, and ERT-3 (787 µg/l), located adjacent to the Busy Bee Cleaners. As a result, the contamination is assumed to have originated from these facilities.

In March and May 1997, EPA REAC conducted additional rounds of groundwater sampling from monitoring and municipal supply wells located in the vicinity of the Vienna and Busy Bee Cleaners. This included two deep wells, VC-1 and VC-2, installed on the Vienna Cleaners property. The PCE detected in monitoring wells VC-2, ERT-3, and ERT-4 located adjacent to the sources (Vienna and Busy Bee Cleaners) ranged from 6,950 µg/l detected from VC-2, to130 µg/l detected from ERT-3.

The current yield of the city's water supply system is 3.45 million gallons per day (MGD). Prior to the affected wells being taken out of service, the yield was 4.35 MGD (approximately 25% higher). The average demand of Vienna is 1.2 MGD, with a peak demand of 2.0 MGD. However, water demand is increasing due to residential and commercial expansion (Weston, 1997).

2.1.1 REGIONAL SETTING

Unless otherwise noted, the 1994 Site Assessment conducted by REAC/Roy Weston, Inc., and the 1997 Preliminary Report, also completed by REAC/Roy Weston, Inc., provided information used in the following sections.

The town of Vienna is located in Wood County, West Virginia. The county is located in the unglaciated Allegheny Plateau section of the Appalachian Plateaus Geomorphic Province. The topography of the area is that of a maturely dissected plateau, characterized by narrow, winding ridges, steep sided stream valleys, and a dendritic drainage pattern. The site is situated on a broad, relatively flat floodplain of the Ohio River.

2.1.2 GEOLOGY AND HYDROGEOLOGY

Descriptions of geology and hydrogeology are presented in the 1994 Site Assessment conducted by REAC/Roy Weston, Inc., and the 1997 Preliminary Report, also completed by REAC/Roy Weston, Inc. The information in the following two subsections has been extracted from that document (except where noted) for presentation in this work plan.

2.1.2.1 Regional Geology

The Vienna PCE site is located on the eastern bank of the Ohio River, which flows southward in the vicinity of the site. Flood plain deposits flank both sides of the river, lying 30 to 40 feet above the low water level. These deposits consist of fine silt, clay, and gravel (fractured shale) approximately 50 to 70 feet thick. Unconsolidated alluvial sediments at the Parkersburg well field, approximately 3.5 miles to the south (downstream along the Ohio River) include: clay (5 to 15 feet thick), very fine sand and silt (10 to 25 feet thick), and sand, gravel and boulders (15 to 25 feet thick). Above the flood plain, older alluvial terraces exist approximately 50 to 65 feet above low water. Most of Vienna, including the site, lies on such a terrace.

This terrace is part of a wedge of unconsolidated alluvial deposits approximately 0.75 miles wide in the Vienna area. Underlying and bordering these deposits to the east are interbedded, nearly horizontal Permian-aged sandstone shales (Dunkard Group of the Washington Formation). The bedrock surface lies at an elevation of approximately 545 feet above mean sea level (amsl), which is approximately 80 feet below ground surface (bgs) in the vicinity of City Hall.

2.1.2.2 Regional Hydrogeology

Groundwater in the alluvium of the Ohio River Valley is derived from infiltration of precipitation and river water. Average annual precipitation in the Ohio River Valley is about 39 inches, and is uniformly distributed throughout the year. There is good hydraulic connectivity between the river and the abutting alluvial strata; the water table fluctuations correspond with changes in the river stage.

Local Hydrogeology

The aquifer at the Vienna PCE site is contaminated with PCE. The aquifer is located 50 feet bgs adjacent to and east of the Ohio River. The aquifer is unconfined and highly transmissive (6,000 to 35,000 square feet per day). The water table has a southward trending hydraulic gradient (0.2%).

Two dissolved PCE plumes, apparently originating from different sources, have been detected in the aquifer at the site. The major plume is believed to have originated from a source at the Vienna Cleaners. Evidence of one plume has been detected in five monitoring wells (ERT-2, ERT-4, ERT-7, VC-1, and VC-2) with groundwater PCE concentrations of up to 6,950 µg/l and is believed to have contributed PCE contamination to Municipal Wells 1 through 6. Evidence of the other plume has been detected in one monitoring well (ERT-3) and probably originated from a source at the Busy Bee Cleaners.

Previous investigations have identified the source of the dissolved phase PCE detected in the aquifer to be a subsurface dense non-aqueous phase liquid (DNAPL) within the vicinity of the Vienna Cleaners. The DNAPL release point appears to be around the northeastern section of the Vienna Cleaners Building. From this point the DNAPL spreads vertically by gravity and laterally by capillarity until all the mass becomes residual. Once the DNAPL is residual it is no longer mobile as a separate phase, but it may partition to the solid, aqueous, and gaseous phases and be subsequently transported elsewhere. The majority of the DNAPL is located from 20 feet bgs down to the water table at 50 feet bgs. There is some DNAPL below the water table, but the mass rapidly decreases after 10 feet of saturation. The fact that most of the DNAPL mass is above the water table is an indicator that the mass released to the subsurface is relatively small. However, even a relatively small volume of PCE as a DNAPL can contaminate an aquifer.

2.1.2.3 Surface Water

The Ohio River is located approximately 1,500 feet west of the Vienna PCE site. The probable point of entry into surface water from the site is on the eastern shoreline of the Ohio River, at River Mile 180.4. The site is situated between the 100-year and 500-year flood plains.

There is a suspected release of PCE into the Ohio River. This is evident from the samples taken by the City of Vienna in their storm sewer lines located along 29th through 34th Streets, with the most notable concentration of PCE in the manhole at 30th street and Grand Central Avenue. Those samples ranged from 250 μg/l on June 5, 1992, to 380 μg/l on July 16, 1992.

3.0 SAMPLING PROGRAM, RATIONALE, AND LOCATIONS

The Field Sampling Plan (FSP) for the Vienna PCE site has been developed to provide the rationale and procedures that will be followed during the performance of the RI/FS and, specifically, for the collection of groundwater samples. The frequency of sampling events, locations of samples, and number of samples that will be collected have been determined based on historical sampling events and discussions with EPA.

3.1 GROUNDWATER SAMPLING FROM CPT LOCATIONS

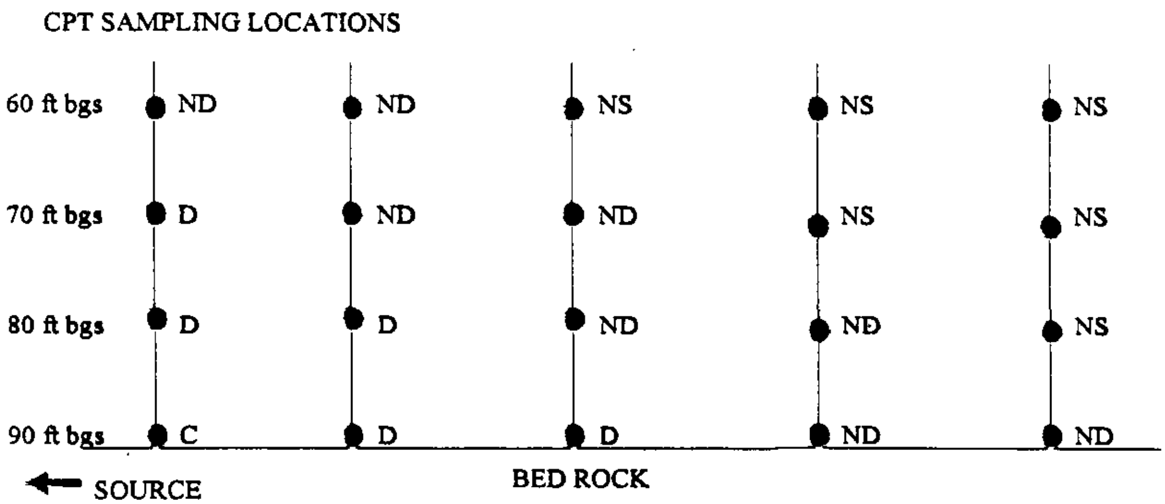
As an initial part of the field investigation, groundwater samples will be collected using a CPT rig equipped with a ConeSipper® or equivalent probe to determine the location of contaminated groundwater. The samples will only be analyzed for PCE, TCE, and cis- and trans-1,2-DCE at an onsite mobile laboratory. The purpose of CPT groundwater sampling is to determine the location of new monitoring wells for more precise delineation of groundwater contamination.

3.1.1 CPT SAMPLING RATIONALE

Groundwater samples will initially be collected along north-south and east-west transects which will pass through the source of PCE contamination, Vienna Cleaners (see Figure 3-1). The remaining CPT sampling locations will be collected along radial transects derived by contouring the historical groundwater PCE results and placing the radial transects equidistant along the estimated PCE plume boundary derived from historical data. The CPT groundwater samples will be collected from approximately four depths per location starting at 60 ft bgs (assuming groundwater is at 50 ft bgs) and will be collected on 10 foot increments down to 90 ft bgs (assumed maximum depth of bedrock). There will be a maximum of 100 CPT sampling locations with an associated maximum of 400 groundwater samples collected during this initial field event. The CPT sampling locations will begin with the north-south and east-west transects which pass through the source of contamination, followed by approximately 15 locations along

CPT locations will be determined in the field, based upon the mobile laboratory results from the initial locations.

In order to define an area of groundwater as "clean", two consecutive CPT sampling locations from the same depth interval must be non-detect for PCE, TCE, and cis- and trans-1,2-DCE. The following diagram displays the sampling rationale along the radial transects:



ND = Non-detect

D= Detect

NS = No sample collected

As displayed in the diagram, two consecutive sampling locations collected from the same depth must be clean before that depth is excluded from sampling. The locations must be radially outwards or inwards (relative to the initial locations along the estimated plume boundary) from the suspected source area. The direction of sampling will be determined based on the analytical results. If all sampling depths are clean then the next CPT sampling location will be radially inwards, and if contamination is detected from any of the sampling depths, the next CPT sampling location will be radially outwards. The distance between CPT sampling locations will initially be 200 feet along all transects. This distance may be modified in the field after review of the CPT groundwater sampling results.

3.1.2 CPT SAMPLING NUMBER AND LOCATION

Initially, 31 CPT locations will be sampled at all four groundwater intervals (60, 70, 80, and 90 feet bgs). The initial locations include north-south and east-west transects which pass through the source, and along the contour developed from previous sampling results. Up to 69 additional locations will be determined in the field in order to define nature and extent of groundwater contamination.

3.2 GROUNDWATER SAMPLING FROM MONITORING WELLS

As part of the field investigation, three rounds of groundwater samples will be collected from existing and new monitoring wells to evaluate the potential impact of contaminant sources on site to the groundwater below the site. The following subsections describe the rationale, number of samples and locations for the groundwater sampling.

3.2.1 MONITORING WELL SAMPLING RATIONALE

Groundwater samples will be collected from monitoring wells to evaluate the impact of site contaminants on groundwater near the site. Specifically, this investigation will evaluate the nature and transport of PCE and other organic materials in groundwater. As part of the site reconnaissance an effort will be made to locate existing monitoring wells. These wells will be evaluated to determine if they are viable sampling locations. Up to 30 new monitoring wells will be installed as part of this investigation. As requested by EPA, no residential or municipal supply wells will be included under this investigation.

3.2.2 MONITORING WELL SAMPLING NUMBER AND LOCATION

As part of the initial phase of the investigation, a well condition survey of existing monitoring wells will be performed by CDM Federal, (see Section 4.3). The survey will include evaluation of the following existing monitoring wells: VC-1, VC-2, ERT-1, ERT-2, ERT-3, ERT-4, ERT-7,

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and SATA-1 (see Figure 3-1). As stated above, a maximum of 30 new monitoring wells will be installed as part of the investigation. The locations of the new wells will be determined by the CDM Federal and EPA hydrogeologists and will be based upon the results of the CPT groundwater sampling. These wells may include up to three bedrock wells with a maximum depth of 150 feet bgs (105 feet overburden and 45 feet bedrock), 16 overburden wells to 90 feet bgs (approximate depth to bedrock), and 11 overburden wells to 60 feet bgs. All of the wells will be of flush-mount design and constructed of 2-inch PVC flush-threaded well pipe and screen (10 feet of screen will be used). As discussed with EPA, ten of the 60-foot bgs overburden wells will be paired with 90-foot bgs wells, and one of the 60-foot bgs wells will be paired with one bedrock well.

Three rounds of groundwater samples will be collected from existing and new monitoring wells, to be discussed below. Purging activities and the collection of all filtered groundwater samples will be collected using a submersible pump, (see Section 4.6). All the remaining samples will be completed using a Teflon® bailer. After development and stabilization of the new monitoring wells, the new and existing monitoring wells will be sampled for the full suite of target compound list (TCL) organics and target analyte list (TAL) inorganics and cyanide, and natural attenuation parameters. The natural attenuation parameters include dissolved methane/ethane/ethene, dissolved organic carbon, hardness (calcium and magnesium), nitrates/nitrites, total iron, total organic carbon, biological oxygen demand, and chemical oxygen demand. Field measurements for pH, conductivity, temperature, dissolved oxygen (measured with a downhole dissolved oxygen probe), and turbidity will be collected during purging and sampling. Other analytes to be measured in the field include alkalinity, dissolved carbon dioxide, chloride, oxygen reduction potential, ferrous/ferric iron, and sulfate.

Quality Assurance/Quality Control (QA/QC) samples, including trip blanks, duplicates, and rinsate blanks (where applicable), will be collected during groundwater sampling activities. A trip blank will be included in each sample shipping container with samples to be analyzed for volatile organic compounds a (VOCs), and a temperature blank will be included in each cooler being shipped. Duplicates and rinsate blanks will be collected at a frequency of one per day or one per 20 samples, whichever is more frequent. Triple volume will be collected for the organic matrix spike/matrix spike duplicate (MS/MSD) samples and double volume will be collected for the inorganic MS/MSD samples at a frequency of one MS/MSD per 20 samples per media.

4.0 FIELD ACTIVITY METHODS AND PROCEDURES

The following sampling-related tasks will be performed by CDM Federal and/or its subcontractors at the Vienna PCE site:

- Site mobilization;
- Procurement of equipment, supplies, and containers;
- Existing monitoring well survey;
- CPT groundwater sampling;
- Onsite mobile laboratory analysis of CPT groundwater samples;
- Monitoring well installation and development;
- Water level measurements;
- Groundwater sampling;
- Field logbook documentation;
- Packaging and shipping of environmental samples;
- Equipment decontamination; and
- Management of sampling wastes.

Where applicable, the subsections in this section reference CDM Federal Technical Standard Operating Procedures (TSOPs; CDM Federal, 1999). If TSOPs are not available, other standard operating procedures are provided. Referenced TSOPs and CPT groundwater sample collection standard operating procedures are provided in Appendix A. Forms that may be used during the sampling activities are provided as Appendix B.

4.1 SITE MOBILIZATION

CDM Federal will identify and provide all necessary personnel, equipment, and materials for mobilization and demobilization to and from the site for the purpose of conducting RI/FS sampling activities. It is anticipated that equipment and supplies will be stored either at the site trailer or at CDM Federal's Fairfax, VA office.

4.2 PROCUREMENT OF EQUIPMENT, SUPPLIES, AND CONTAINERS

CDM Federal has identified the equipment and supplies necessary to support field activities. These items have been summarized in Table 4-1. This table separates field items into the following categories: sampling, health and safety equipment, decontamination equipment, and general field operations. All measurement and test equipment will be handled in accordance with TSOP 5-1, Control of Measurement and Test Equipment. TSOP 5-1 is included in Appendix A.

All sample containers will be precleaned and traceable to the facility that performed the cleaning. Sampling containers will not be cleaned or rinsed in the field. A discussion of required containers and preservatives is included in Section 6.2.2 of this SMP.

4.3 EXISTING MONITORING WELL SURVEY

As part of the initial phase of the investigation, a well condition survey of existing monitoring wells will be performed by CDM Federal. The survey will consist of collecting water levels and verifying total depth within each monitoring well and estimating the amount of silt in each well (if any). In addition, a 1.5-inch or 3.5-inch diameter PVC "slug" will be lowered to the bottom of each existing 2-inch or 4-inch well as appropriate, to identify any potential obstructions or alignment problems within the monitoring well. An example well condition survey form and rational is included in Appendix B, Field Forms. Any issues with well integrity will be brought to the attention of EPA and a determination will be made whether or not to include the well in future sampling events. Table 4-2, Existing Monitoring Well Data, lists the available construction and water level data from the existing monitoring wells.

4.4 CPT GROUNDWATER SAMPLING

Up to 100 locations with a maximum of 400 groundwater samples will be collected with a CPT rig equipped with a ConeSipper® or equivalent probe. The CPT groundwater sampling results will be used to determine the location of new monitoring wells for more precise delineation of groundwater contamination.

The CPT sampling locations will begin with the north-south (9 locations) and east-west (10 locations) transects which will pass through the source of contamination. The next CPT sampling locations, approximately 12, are along the estimated plume boundary derived from historical data (see Figure 3-1). The remaining CPT locations will be determined in the field, based upon the mobile laboratory results from the initial locations.

Up to four groundwater samples will be collected at each location on the sample grid for analysis by the onsite mobile laboratory (see Section 3.1.1 for sampling rationale). CPT groundwater samples will be analyzed for PCE, TCE and cis- and trans-1,2-DCE, and will be used as screening data. A typical SOP for the CPT groundwater sampling is included in Appendix A.

4.5 ONSITE MOBILE LABORATORY ANALYSIS OF CPT GROUNDWATER SAMPLES

Screening level CPT groundwater samples will be analyzed in the field by an onsite mobile laboratory for PCE, TCE, and cis- and trans-1,2-DCE. The onsite mobile laboratory will utilize SW-846 Method 8010 Modified, or equivalent, to achieve at a minimum the EPA maximum contaminant level (MCL) as listed in the EPA Drinking Water Regulations and Health Advisories, for each of the abovementioned contaminants. The ultimate goal is to achieve the minimum screening levels as defined in either the EPA Drinking Water Regulations and Health Advisories, or the EPA Region III Risk Based Concentrations for tap water. The limitations of the mobile laboratory's analytical methods will determine the achievable CPT groundwater analytical goals (see Section 5.4). Table 5-1 lists the screening goal concentrations for each of CPT groundwater parameter.

4.6 MONITORING WELL INSTALLATION AND DEVELOPMENT

Up to 30 new monitoring wells will be installed as part of the investigation. Decisions regarding the location and screen interval for the new wells will be decided by the CDM Federal and EPA hydrogeologists and will be based upon the results of the CPT groundwater results. The wells may include up to three bedrock wells with a maximum depth of 150 feet bgs (105 feet overburden and 45 feet bedrock), 16 overburden wells to 90 feet bgs, and 11 overburden wells to 60 feet bgs. All of the wells will be of flush-mount design and constructed of 2-inch PVC flush-threaded well pipe and screen (10 feet of screen will be used). As discussed with EPA, ten of the 60 feet bgs overburden wells will be paired with 90 feet bgs wells, and one of the 60 feet bgs wells will be paired with one bedrock well.

Monitoring well boreholes will be drilled with a hollow-stem auger (HSA) rig with a contingency for mud or air rotary. Split spoon samples will be collected on five foot centers from the ground surface to the bottom of the borehole, if possible. The lithology of the split spoon samples will be logged, and the soil scanned with a photoionization detector (PID). Lithologic logging will be performed in accordance with CDM Federal TSOP 3-5, Lithologic Logging. Wells will be constructed of Schedule 40 PVC, with a 10-foot screen, and will be 2 inches in diameter. Design and installation of the monitoring wells will follow CDM Federal TSOP 4-4.

Soil cuttings generated during drilling activities will be drummed and moved to a secure area of the site for later disposal (see Section 4.11).

Monitoring well development will be performed no sooner than 24 hours after grouting is complete and within one week of well installation. The well purging will be accomplished by pumping the well with a submersible pump tolerant of suspended solids followed by intermittent surging with a surge block. Well development will follow CDM Federal's TSOP 4-3, Well Development and Purging. All development water will be contained and handled as potentially hazardous material (See Section 4.10).

4.6.1 OVERBURDEN WELLS

Overburden wells will be constructed of 2-inch PVC casing and screen. A 10-foot screen will be used, with the actual depth and location to be determined based upon CPT groundwater results. The intent of the overburden monitoring wells is to delineate the PCE groundwater plume both vertically and horizontally. One cluster consisting of a 60-foot and a 90-foot overburden well will be established, after CPT sampling and evaluation is complete, to serve as background wells.

4.6.2 BEDROCK WELL INSTALLATION

A surface casing will be installed for each bedrock well. The surface casings will be 6-inch diameter carbon steel with welded or screwed joints. The surface casing will be cemented in place a minimum of 5 feet into competent bedrock. Planned installation of the surface casing will be with the use of a cable tool drill rig or other similar "drive casing" method. This will require the temporary installation of 10-inch steel casing prior to installing the 6-inch casing. Bedrock wells will be constructed of 2-inch PVC riser and screen with a screen length of 10 feet.

For the bedrock wells, a 6-inch diameter hole will be drilled in bedrock by air hammer from the bottom of the surface casing to a maximum depth of 150 feet. During drilling, observations will be made of cuttings returned, the rate of drill advancement, and apparent water producing zones. At the conclusion of drilling, the hole will be developed for a minimum of one hour with air through the drill stem to remove fines from the bottom and walls of the open borehole. Whenever the drilling or development with air is performed, an air filter will be employed to prevent contaminants, specifically VOCs, from being introduced in the borehole by these operations. The open borehole will be converted into the monitoring well after completion of well development.

4.7 WATER LEVEL MEASUREMENTS

Water level measurements will be collected from all monitoring wells prior to sampling. Three rounds of synoptic water levels will be collected from the new and existing monitoring wells, one per sampling event. Water levels will be obtained in accordance with CDM Federal TSOP 1-6, Water Level Measurement. Prior to collecting water level measurements, CDM Federal personnel will measure organic vapors emanating from the open wells. Organic vapors will be measured in accordance with TSOP 1-10, Field Measurement of Organic Vapors. TSOPs 1-6 and 1-10 are included in Appendix A.

4.8 MONITORING WELL SAMPLING

Monitoring wells will be purged using a Grundfos Redi-Flo 2 submersible pump. Filtered samples will be collected using the Grundfos Redi-Flo 2 and the remaining samples will be collected using Teflon® bailers. Purging will be completed following CDM Federal TSOP 4-3, Well Development and Purging. Sampling will be completed following CDM Federal TSOP 1-5, Groundwater Sampling Using Bailers as modified in this FSP to include collecting filtered samples with the Grundfos Redi-Flo 2 submersible pump. TSOPs 1-5 and 4-3 are provided in Appendix A.

New and existing wells will be purged using a 2-inch diameter Grundfos Redi-Flo 2 submersible pump. The pump will be set 2 to 4 feet above the bottom of the screened interval in each well to be sampled. Table 4-3 lists the field parameters as well as onsite and offsite analyses that will be collected from each well.

Groundwater samples are to be collected from new and existing monitoring wells associated with Vienna and Busy Bee Cleaners. Sampling will be conducted in the following sequence:

Pre-Sampling

1. Check well for damage or evidence of tampering, record pertinent observations.
2. Lay out sheet of polyethylene for monitoring and sampling equipment.
3. Measure VOCs at well head with a PID by cracking inner cap slightly and recording initial reading. Record second reading with inner well cap completely removed. Record both readings in field logbook.
4. Measure and record depth to water (to 0.01 feet) in all wells prior to sampling. Measure from the mark on the well casing or if no reference mark exists, make one on north side of the casing.
5. Record all pertinent information in the field log book (see Section 4.5), including:
   - well location, sampling depth, total depth, sample identification (ID), date and time;
   - well purging activities, volume removed, pumping rate, and;
   - field measurements (pH, specific conductance, oxidation reduction potential (ORP), dissolved oxygen (DO), temperature, turbidity)
   - dissolved oxygen will be collected from the well before purging activities, and will not be collected continuously while purging.
6. Calculate the standing water volume in the well.

Purging

7. Install Pump: Lower the pump, safety cable, tubing, and electric cable slowly into the well. The pump should be lowered to a depth within the screened interval that is determined to be a water producing zone or to the bottom of the saturated screen. The safety cable can be secured once the appropriate depth has been reached. The pump intake must be kept at least two feet above the bottom of the well to prevent mobilization of sediments.
8. Measure Water Level: Before starting the pump measure the water level again with the pump in the well.

9. Purging: Start the pump at the lowest rate possible (100 ml/min) while measuring drawdown continuously. Increase the pumping rate slowly, in order to limit the amount of drawdown and establish a pumping and drawdown equilibrium. If the well has such a low yield that the well can be pumped dry, even at a low setting, pumping should be stopped and the well allowed to recover repeatedly until there is sufficient volume in the well to allow for sampling.

10. Monitor Indicator Parameters: While purging, monitor water quality parameters with a YSI Model 6820 water quality meter or equivalent model. The water quality meter will be used to measure turbidity, temperature, specific conductance, pH, and ORP. Readings will be collected every three to five minutes or every well volume, whichever is more frequent, and recorded in the field logbook or on specific water quality monitoring data sheets. Readings will be collected until the parameters have stabilized and a minimum of three well volumes has been purged. Stabilization is achieved when three consecutive readings are within $\pm$ 0.1 for pH, $\pm$ 3% for conductivity and temperature, $\pm$ 10 mv for ORP, and $\pm$ 10% for turbidity.

Sample Collection

11. Collect Filtered Samples: Collect filtered samples at a flow rate between 100 and 250 ml/minute. Samples will be collected from the discharge tubing and a 0.45 micron filter. The filter must be used with the Grundfos submersible pump in order to provide adequate pressure to force the water through the filter. The parameters collected using the filter are listed in Table 4-3.

12. Remove Pump and Tubing: After collection of the filtered samples the pump and tubing will be removed from the well. The tubing and submersible pump will be decontaminated (see Section 4.7).

13. Collect Unfiltered Samples: The unfiltered samples listed in Table 4-3 will be collected with a Teflon® bailer in accordance with TSOP 1-5.

Filtered groundwater samples will be collected in the following order:

- Dissolved organic compounds
- Dissolved metals
- Natural attenuation parameters

Unfiltered groundwater samples will be collected in the following order:

- Volatile organic compounds
- Semi-volatile organic compounds
- Pest/PCBs
- Total organic carbon
- Total metals
- Cyanide
- Natural attenuation parameters

4.9 FIELD LOGBOOK DOCUMENTATION

All field activities will be documented in a field logbook. All documentation activities will be performed in accordance with CDM Federal TSOP 4-1, Field Logbook Content and Control. TSOP 4-1 is included in Appendix A.

4.10 PACKAGING AND SHIPPING OF ENVIRONMENTAL SAMPLES

While groundwater samples collected via the CPT rigs will be analyzed by the onsite mobile lab, all existing and new monitoring well samples will be analyzed through the Contract Laboratory Program. All samples to be analyzed via CLP will be packaged and shipped in accordance with CDM Federal TSOP 2-5, Packaging and Shipping of Environmental Samples. SOP 2-5 is presented in Appendix A.

4.11 EQUIPMENT DECONTAMINATION

Drilling equipment (augers, split spoons), CPT equipment, and groundwater sampling equipment (pumps and bailers) will all require decontamination. Split spoons, auger flights, and CPT equipment will be cleaned by the subcontractor using a high pressure hot water washer. Any specialized CPT groundwater sampling equipment will be further cleaned using the full decontamination procedures applied to all sampling equipment. Sampling equipment will be decontaminated in accordance with CDM Federal TSOP 4-5, Field Equipment Decontamination at Nonradioactive Sites. The EPA Region III-required solvent, methanol and a 10% nitric acid solution, will be used to clean all sampling equipment. TSOP 4-5 is presented in Attachment A, and includes:

1. Liquinox detergent scrub
2. Rinse with clean potable water
3. Rinse with ultra pure 10% nitric acid
4. Rinse with ASTM Type II water.
5. Rinse with methanol
6. Rinse with ASTM Type II water.
7. Air dry
8. Wrap with aluminum foil (shiny side out).

4.12 MANAGEMENT OF SAMPLING WASTES

CDM Federal will utilize a portable decontamination area to decontaminate sampling equipment. The CDM Federal Site Manager will ensure that all sampling wastes are handled in accordance with CDM Federal TSOP 2-6, Guide to Handling of Investigation-Derived Waste (IDW), provided in Appendix A. IDW generated from sampling activities are likely to include used personal protective equipment (PPE), dry solid waste (tubing, plastic sheeting, bags, sampling equipment, etc.), decontamination water, development water, purge water, and drill cuttings generated during monitoring well installation, and purge water during sampling activities. These wastes will be placed in DOT approved drums and/or roll-off containers (for solids), and tanks with secondary containment (for liquids). All drums, tanks, and containers will be labeled and dated for storage prior to testing and disposal. CDM Federal estimates 86 drums to handle PPE and related items (e.g. plastic sheeting and hosing), 4 roll-off containers to handle drill cuttings, and 115 55-gallon drums to handle purge water, drilling water, and spent decontamination fluids.

Investigation-derived waste (IDW) from the field investigation will be disposed of in accordance with all applicable Resource Conservation and Recovery Act (RCRA) and Toxic Substance Control Act (TSCA) regulations by a waste removal/disposal firm under subcontract to CDM Federal. CDM Federal personnel will perform field oversight and health and safety monitoring during three waste disposal field activities (one after drilling, one after the first round of groundwater sampling, and the final one after the two additional groundwater sampling rounds).

PART II: QUALITY ASSURANCE PROJECT PLAN

5.0 PROJECT MANAGEMENT

As discussed in Section 1, Sections 5 through 9 of this SMP constitute the Quality Assurance Project Plan (QAPP) for this project. The QAPP was prepared in accordance with EPA QA/R-5 guidance for preparing QAPPs (EPA 1999), CDM Federal's RAC Region III Quality Assurance Project Plan (CDM Federal 1997a), and EPA Region III requirements. This section covers the basic area of project management, including the project organization, background and purpose, project description, quality objectives and criteria, special training, and documentation and records.

5.1 PROJECT ORGANIZATION AND RESPONSIBILITY

Organization and responsibilities specific to this investigation are discussed in this section and an organization chart is provided as Figure 5-1. CDM Federal will provide the necessary technical staff to perform sampling and reporting aspects of the project. At the present time, it is anticipated that laboratory services will be provided by either EPA's Office of Analytical Services and Quality Assurance (OASQA), the EPA's CLP program, or EPA's Delivery of Analytical Services (DAS) program.

5.1.1 MANAGEMENT ORGANIZATION

The CDM Federal Project Manager for the Vienna PCE site is Mr. David Schroeder. Mr. Richard Doucette, acting as Site Manager, will be responsible for directing field sampling activities. Mr. Jim Romig is the Analytical Services Coordinator who will be responsible for coordinating sampling activities with OASQA and EPA's Regional Sampling Control Center (RSCC). Ms. RoseMary Gustin is the Region III RAC Quality Assurance (QA) Manager. Ms.

Mary Jo Apakian and Mr. Rich Opem are the RAC III Regional QA Coordinators who will oversee project designated QA activities.

Mr. Schroeder, as Project Manager, is responsible for the overall management and coordination of the following activities:

- maintaining communications with EPA regarding the status of this project;
- preparing monthly status reports;
- supervising production and review of deliverables;
- providing oversight of subcontractors;
- coordinating lab assignments;
- reviewing analytical results and deliverables from subcontractors;
- tracking work progress against planned budgets and schedules;
- incorporating and informing EPA of changes in the Work Plan, SMP, HASP, and/or other project documents;
- notifying the CDM Federal Region III RAC QA Manager or local QA Coordinators immediately of significant problems affecting the quality of data or the ability to meet project objectives;
- scheduling personnel and material resources;
- implementing field aspects of the cleanup validation;
- implementing the QC measures specified in CDM Federal's QAPP (CDM Federal 1997a) for this contract, Quality Management Plan (QMP) (CDM Federal 1997b) for this contract, this QAPP, and other project documents;
- implementing corrective actions resulting from staff observations, QA/QC surveillance, and/or QA audits;
- providing oversight of data management; and,
- providing oversight of report preparation.

Mr. Doucette, as Site Manager, is responsible for the following:

- organizing and conducting a field planning meeting;
- coordinating and overseeing the efforts of the subcontractors providing sampling and operations support;
- scheduling and conducting field work;
- notifying the analytical laboratories of scheduled sample shipments and coordinating work activities;
- gathering sampling equipment and field logbooks and confirming required sample bottles and preservatives;
- maintaining proper chain-of-custody forms and shipping samples to the analytical laboratory during sampling events;
- ensuring that sampling is conducted in accordance with procedures detailed in this QAPP and the Field Sampling Plan (FSP) for this project and that the quantity and location of all samples meet the requirements of the FSP; and,
- identifying problems at the field team level, resolving difficulties in consultation with the QA staff, implementing and documenting corrective action procedures at the field team level, and providing communication between the field teams and CDM Federal management.

Mr. Jim Romig, as Analytical Services Coordinator, will be responsible for the following:

- coordinating with EPA for delivery of appropriate paperwork for sample collection, custody, and shipping;
- scheduling required laboratory analytical services with OASQA or CLP through RSCC; and,
- distribution of analytical results to appropriate team members.

The roles and responsibilities of other field team members will be to assist the Site Manager with sampling activities, sample handling, and overall documentation.

5.1.2 QUALITY ASSURANCE ORGANIZATION

The QA program is implemented by CDM Federal's Region III RAC QA Manager, Ms. Gustin. Ms. Gustin is independent of the technical staff and reports directly to the President of CDM Federal on QA matters. The QA Manager has the authority to objectively review projects and identify problems, and the authority to use corporate resources, as necessary, to resolve any quality-related problems.

The RAC III Regional Coordinators for this project, Ms. Apakian and Mr. Opem, report to Ms. Gustin on QA matters. Under Ms. Gustin's oversight, they are responsible for the following:

- reviewing and approving the project-specific plans;
- directing the overall project QA program;
- maintaining QA oversight of the project;
- reviewing QA sections in project reports, as applicable;
- reviewing QA/QC procedures applicable to this project;
- performing self-assessments for selected activities of this project performed by CDM Federal and subcontractors, as necessary;
- initiating, reviewing, and following-up on response actions, as necessary;
- maintaining awareness of active projects and their QA/QC needs;
- consulting with the CDM Federal QA Project Manager, as needed, on appropriate QA/QC measures and corrective actions;
- conducting internal system audits to check on the use of appropriate QA/QC measures, if applicable; and,
- providing monthly written reports on QA/QC activity to the CDM Federal QA Manager.

5.1.3 REPORT ORGANIZATION

Sections 5 through 8 of this SMP are organized in accordance with *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5, Draft Final*, August 1997 (EPA 1997). Section 5.0 presents project management and introductory information. Section 6.0 provides guidance for measurement and data acquisition. Section 7.0 details assessment and oversight aspects of the project, and Section 8.0 describes data validation and usability issues. References for the entire SMP are listed in Section 11.0.

5.2 BACKGROUND AND PURPOSE

Site background information for the Vienna PCE site is provided in Section 2.0 of the SMP. The objectives of this assignment are discussed in Section 1.1 of the SMP. The purpose of this QAPP is to provide guidance to ensure that all environmentally-related data collection procedures and measurements are scientifically sound and of known, acceptable, and documented quality conducted in accordance with the requirements of the project.

5.3 PROJECT DESCRIPTION

The QAPP addresses the field work that will be performed during the completion of the RI/FS at the site. Screening level groundwater samples collected during CPT activities will be used to determine new monitoring well placement. The CPT groundwater samples will be analyzed for PCE, TCE and cis- and trans-1,2-DCE, using an onsite mobile laboratory. Monitoring well groundwater samples will be collected from locations throughout the site. Three rounds of groundwater samples will be collected from new and existing monitoring wells. The first round of groundwater samples will be analyzed for the full suite of both TCL organics and TAL inorganic compounds including cyanide, and the following natural attenuation parameters:

Dissolved Methane/ethane/ethene	Dissolved Organic Carbon

Ca^{+2} Hardness	Mg^{+2} Hardness
NO^{-3} / NO^{-2}	Total Iron
TOC	BOD
COD	

The following natural attenuation parameters will be collected and analyzed in the field:

Alkalinity	Dissolved CO_2
Chloride	Dissolved Oxygen
Oxidation Reduction Potential (ORP)	Temperature
pH	Specific Conductivity
Turbidity	Fe^{+3}/Fe^{+2}
Sulfate	

Based on a review of the first round of analytical results, CDM Federal in consultation with EPA may limit the number of parameters analyzed under the TCL organics or the TAL inorganic compounds. The natural attenuation parameters will remain the same for all three rounds of groundwater sampling. Sampling activities and all associated procedures are described in detail in this QAPP and the FSP.

5.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT

This section provides internal means for control and review so that environmentally-related measurements and data collected by CDM Federal are of known quality. Data collected on this project will be used to:

- Ascertain if there is a threat to public health or the environment.
- Identify the vertical and horizontal boundaries of the contaminated groundwater

- Determine the potential contaminants of concern (PCOC).
- Sampling data will be used to formulate remediation strategies, and estimate remediation costs.

When conducting this investigation, all measurements will be made so that results are reflective of the medium and conditions being measured. Prior to all environmental measurement activities, site-specific Data Quality Objectives (DQOs) and measurement performance criteria will be determined. DQOs are qualitative and quantitative statements which specify the quality of the environmental monitoring data required to support decisions. The subsections below describe the DQOs (Section 5.4.1) and data measurement objectives (Section 5.4.2) developed for this assignment.

5.4.1 DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps based on the scientific method that are designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended purpose. The development of DQOs focuses on the end use of the collected data and on determining the degree of certainty with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC) necessary to satisfy the end use.

The EPA document *Guidance for the Data Quality Objectives Process* (EPA 1994) provides guidance for the development of site specific DQOs. The DQO process is intended to:

- clarify the study objectives;
- define the most appropriate type of data to collect;
- define the most appropriate conditions from which to collect the data; and
- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the design.

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical methods necessary to generate the specified data quality. The process also ensures that the resources required to generate the data are justified. DQOs developed during the planning stages of this project will be referenced throughout various planning documents and used during the implementation of the project. The DQO process consists of seven steps of which the output from each step influences the choices that will be made later in the process. These steps include:

Step 1: *State the problem;*
Step 2: *Identify the decisions;*
Step 3: *Identify the inputs to the decision;*
Step 4: *Define the study boundaries;*
Step 5: *Develop the decision rule;*
Step 6: *Specify tolerable limits on decision errors; and*
Step 7: *Optimize the design.*

During the first six steps of the DQO process performance criteria will be developed that will be used to develop the data collection design. The final step of the process involves the specific development and refinement of the data collection design based on the DQOs. A brief discussion of the steps and their application to the project is provided below.

5.4.1.1 Step 1: State the Problem

The purpose of this step is to describe the problem to be studied so that the focus of the study will be unambiguous. Previous investigations and inspections of the Vienna PCE area identified groundwater primarily contaminated with PCE.

The city of Vienna is currently supplied by eight municipal supply wells, which draw water from the aquifer underlying the city. Prior to 1995 the city of Vienna was supplied by 12 municipal wells, all of which are located in five clusters throughout the city. PCE was initially detected in four municipal supply wells in February 1992, and two more municipal supply wells in September 1992. All six wells with PCE contamination are no longer in service. In order to keep up with the demand for water, the city installed two new wells in 1995, and brought the two new wells online in 1997. The following is a summary of the findings regarding the Vienna PCE site.

PCE contamination was first detected in February 1992 at Municipal Wells 1 through 4, located at City Hall. The highest concentrations of PCE detected in wells 1 through 4 were 170, 390, 8, and 7 micrograms per liter (μg/l), respectively. These samples were collected by the city on June 2, 1992, and the city of Vienna discontinued the use of these wells on June 11, 1992.

Municipal Wells 5 and 6 are located approximately 1000 feet northwest of City Hall and Municipal Wells 1 through 4. Municipal Wells 5 and 6 were removed from service in 1991, prior to detection of PCE, due to benzene leaking from an underground storage tank (UST). Groundwater samples collected from these wells by West Virginia Department of Environmental Protection (WVDEP) on September 22 and 24, 1992 had PCE concentrations of 70 μg/l and 0.5 μg/l, respectively.

In May 1993 and 1994, REAC personnel completed two phases of investigation at the site. The first phase of the investigation consisted of a soil gas survey to assess the source(s) and extent of contamination in the subsurface. The second phase of the investigation consisted of installing, developing, and sampling four groundwater monitoring wells (ERT-1 through ERT-4) located within the contaminated aquifer (see Figure 2-1). The primary contaminant found at the site was PCE with very few degradation by-products. REAC personnel installed and tested two exploratory wells (ERT-5 and ERT-6) in the area suspected to be free of contamination to evaluate their suitability for use as new municipal supply wells.

In March and May 1997, EPA REAC conducted additional rounds of groundwater sampling from monitoring and municipal supply wells located in the vicinity of the Vienna and Busy Bee Cleaners. This included two deep wells, VC-1 and VC-2, installed on the Vienna Cleaners property. The PCE detected in monitoring wells ERT-3, adjacent to Busy Bee Cleaners, and VC-2, and ERT-4 located adjacent to Vienna Cleaners, ranged from 6,950 µg/l detected from VC-2, to130 µg/l detected from ERT-3.

The REAC investigations identified a PCE plume in the soil gas and groundwater extending from just north of the Vienna Cleaners to the south as far as the intersection of Grand Central Avenue and 27th Street. The highest PCE concentrations were found, in both soil gas and groundwater, in the vicinity of the Vienna Cleaners and the Busy Bee Cleaners. The highest PCE groundwater concentrations adjacent to each source were present in ERT-3 (787 µg/l) and in VC-2 (6,950 µg/l). As a result, the contamination is assumed to have originated from these facilities.

The city of Vienna is concerned about future PCE contamination, because other municipal supply wells appear to be hydraulically downgradient from the currently contaminated wells.

The extent and full nature of contamination at this site have not been fully delineated. Sufficient information on onsite sources and types of contamination have been collected. Final contaminant migration pathways have not been identified.

5.4.1.2 Step 2: Identify the Decision

The goal of the RI is to characterize the nature and extent of site-related contamination in the groundwater. The data generated from the investigation will be used to support a risk assessment and provide information for an initial evaluation of appropriate remediation technologies. The determination regarding whether a feasibility study or EE/CA will be performed will be made by EPA after the first round of groundwater sample data are available. The principal study questions are:

- Does contamination at or adjacent to the site pose a risk to ecological and human receptors.
- What is the nature and extent of groundwater contamination at the site?

The following resolution to the questions and possible actions have been identified:

Questions 1 and 2

- Prepare human health risk assessments on current site conditions.
- Prepare a screening level ecological effects evaluation.
- Chemical and hydrogeologic data collected during the CPT groundwater sampling and subsequent monitoring well sampling will define the nature and extent of groundwater contamination.
- Utilize groundwater sampling data to determine whether a feasibility study or a EE/CA will be performed.

5.4.1.3 Step 3: Identify the Inputs to the Decision

The purpose of this step is to identify the information and data that need to be obtained and the measurements that need to be taken to resolve the decision statement. Based on the question presented in Step 1, the following information is required:

Chemical analysis of groundwater samples (TCL organics, TAL inorganics including cyanide, and natural attenuation parameters) as well as elevation and hydraulic data are needed to confirm the nature and extent of groundwater contamination.

The main source of the chemical characterization information required will be the analytical results from the proposed groundwater sampling and historical data including regional background concentrations. The main sources of information used to assess impact to human and ecological receptors are screening levels obtained from EPA documents. In EPA Region III the screening levels include the Risk-Based Concentrations (RBCs). The screening levels are considered the preliminary remediation goals (PRG) for this study.

The selected analytical methods for the initial investigation will have standard quantitation limits as found in the USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Low Concentration Water, OLC02.1, for volatile organics only, USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, OLM04.2, for SVOC and Pest/PCB analyses, and USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, ILM04.0.

These quantitation limits will provide information to determine the boundaries of the groundwater contaminant plume and will meet the risk based DQOs. The historical data from REAC identified the source of the contamination, and the potential contaminants of concern. The data available are at levels above the Region III RBC's. In order to define the boundaries of the groundwater contaminant plume and to meet the risk based DQO's, the quantitation limits identified in USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Low Concentration Water, OLC02.1, will be used.

5.4.1.4 Step 4: Define the Boundaries of the Study

This step defines the spatial and temporal boundaries of the study.

The horizontal spatial boundaries of the study area include the city of Vienna and the surrounding residential and commercial areas located around the PCE groundwater contaminant plume. The boundaries of the study area will be developed during the CPT groundwater sampling phase of the study. The vertical spatial boundaries are from ground surface to a depth of 50 feet into the competent bedrock which begins from 80 to 100 feet below ground surface. This study focuses on current conditions and, therefore, temporal boundaries include the time frame for the RI (2000 to 2002). The main data used for decision-making will be collected from current conditions although the contamination may have been historically deposited. The populations needed for decision-making for this investigation include the chemical concentrations (including both detected and non-detected values) for all media sampled and analyzed. Constraints that could potentially interfere with data collection are physically inaccessible sampling locations and a limited number of sampling events.

5.4.1.5 Step 5: Develop a Decision Rule

The purpose of this step is to define the parameter of interest, specify the action level, and integrate previous DQO outputs into a single statement that describes a logical basis for choosing among alternative actions. During the course of the project the tasks outlined in the SMP will be followed. While performing the tasks decisions will be made to collect sufficient data and maintain the progress of the assignment. Several example logic statements are presented below that will help guide the Vienna PCE project.

- If residential wells are identified within a 0.25 mile radius of the site, then the U.S. EPA will be provided the information and the Agency will decide if they shall be sampled.
- If field parameters stabilize to within limits defined in Section 4.6 during purging, then a groundwater sample will be collected.
- If levels above background are identified during CPT sampling at the edge of the sampling grid, the grid will be extended outwards another 200 feet, and another sample will be collected. The process will be repeated until two "clean" samples are collected for each sampling depth.
- If the CPT rig hits refusal above bedrock, the rig will offset once and attempt to resample beginning at the depth of refusal.

- If gross contamination (e.g., unusual colors and high photoionization detector (PID) readings) is noted during CPT groundwater sampling or during monitoring well installation, the U.S. EPA will be notified and a course of action will be determined.

The parameters of interest are the concentrations of constituents identified for the groundwater. These concentrations should estimate the true values of the constituents and may be used on an individual (i.e., PCE) basis or cumulatively (i.e., total polycyclic aromatic hydrocarbons). The action levels for each constituent may be a permitted limit, background concentration, or risk based concentrations. Logic statements for the risk assessment portion of the project are presented below.

- If the maximum chemical concentration exceeds the screening level, then the chemical will be evaluated in the Baseline Risk Assessment (BLRA).
- If the BLRA shows that a chemical's risks exceeds the acceptable risk level, then EPA will determine if the site will be evaluated via a FS.
- If distribution testing shows the chemical follows a normal distribution, then the normal upper confidence limit (UCL) will be calculated.
- If the nature and extent of contamination has been properly defined and the human health risk assessment (HHRA) is sufficiently comprehensive, then a proper remedial action may be chosen for the site.

Standard rounding rules will apply. If the figure following those to be retained is less than five, round it down. If the figure is greater than five, drop it and increase the last digit to be retained by one (i.e., round up). If the figure following the last digit to be retained equals five and there are no digits to the right of the five or all of the digits to the right of the five equal zero, then increase the digit to be retained by one if the digit to be retained is odd, or retain the digit if the digit is even. For example, if the figure to be rounded is 11.25, the number would be rounded to 11.2, or if the figure is 11.35, the number would be rounded to 11.4.

5.4.1.6 Step 6: Specify Tolerable Limits on Decision Errors

Decision maker's tolerable limits on decision errors, which are used to establish performance goals for the data collection design, are specified in this step. Decision makers are interested in knowing the true value of the constituent concentrations. Since analytical data can only estimate these values, decisions that are based on measurement data could be in error (decision error). Two reasons why the decision maker may not know the true value of the constituent concentration follow:

(1) Concentrations may vary over time and space. Limited sampling may miss some features of this natural variation because it is usually impossible or impractical to measure every point of a population. *Sampling design error* occurs when the sampling design is unable to capture the complete extent of natural variability that exists in the true state of the environment.

(2) Analytical methods and instruments are never absolutely perfect, hence a measurement can only estimate the true value of an environmental sample. *Measurement error* refers to a combination of random and systematic errors that inevitably arise during the various steps to the measurement process.

The combination of sampling design and measurement errors is the total study error. Since it is impossible to completely eliminate total study error, basing decisions on sample concentrations may lead to a decision error. The probability of decision error is controlled by adopting a scientific approach in which the data are used to select between one condition (the null hypothesis) and another (the alternative hypothesis). The null hypothesis is presumed to be true in the absence of evidence to the contrary. For this project the null hypothesis is that the true values of the constituents are below the action levels. The alternative hypothesis is that the true values of the constituents are above the action levels.

The closer the reported concentration is to the action level, the higher the probability that an incorrect decision will be made and, therefore, there is a "gray region" surrounding the action level. To provide a factor of safety and reduce or eliminate an incorrect decision, the maximum concentration is used to screen the data.

5.4.1.7 Step 7: Optimize the Design for Obtaining Data

This step identifies a resource-effective data collection design for generating data that are expected to satisfy the DQOs. The data collection design (sampling program) is described in detail in the FSP, Part I of this SMP.

5.4.2 DATA MEASUREMENT OBJECTIVES

Screening level CPT groundwater samples will be analyzed in the field by an onsite mobile laboratory for PCE, TCE, and cis- and trans-1,2-DCE. The onsite mobile laboratory will utilize SW-846 Method 8010 Modified or equivalent to achieve at a minimum the EPA maximum contaminant level (MCL) as listed in the EPA Drinking Water Regulations and Health Advisories for the abovementioned contaminants. The ultimate goal is to achieve the minimum screening levels as defined in either the EPA Drinking Water Regulations and Health Advisories, or the EPA Region III RBCs for tap water. The limitations of the mobile laboratory's analytical methods will determine the achievable CPT groundwater analytical goals. Table 5-1 lists the screening goal concentrations for each of CPT groundwater parameter.

Monitoring well groundwater samples will be analyzed at a fixed based laboratory for TCL organics, TAL inorganic compounds including cyanide, and natural attenuation parameters including:

Dissolved Methane/ethane/ethene	Dissolved Organic Carbon
Ca^{+2} Hardness	Mg^{+2} Hardness

NO^{-3} / NO^{-2}	Total Iron
TOC	BOD
COD	

The following natural attenuation parameters will be collected and analyzed in the field:

Alkalinity	Dissolved CO_2
Chloride	Dissolved Oxygen
Oxidation Reduction Potential	Temperature
pH	Specific Conductivity
Turbidity	Fe^{+3}/Fe^{+2}
Sulfate	

Note that dissolved oxygen will be collected from the well before purging activities, and will not be collected continuously while purging.

Every reasonable attempt will be made to obtain a complete set of usable field measurements and analytical data. If a measurement cannot be obtained or is unusable for any reason, the effect of the missing data will be evaluated by the CDM Federal project manager and CDM Federal QA staff. This evaluation will be reported to EPA with a proposed corrective action.

5.4.2.1 Quality Assurance Guidance

The field QA program has been designed in accordance with CDM Federal's RAC III QAPP (CDM Federal 1997a), the QMP for this contract (CDM Federal 1996), EPA's Guidance for the Data Quality Objectives Process (EPA 1994), and the EPA's Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA 1997).

5.4.2.2 Precision, Accuracy, Representativeness, Completeness, and Comparability Criteria

Precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are indicators of data quality. PARCC goals are established for the site characterization to aid in assessing data quality. The following paragraphs define these PARCC parameters in conjunction with this project.

Precision. The precision of a measurement is an expression of mutual agreement among individual measurements of the same property taken under prescribed similar conditions. Precision is quantitative and most often expressed in terms of relative percent difference (RPD).

Precision of the laboratory analyses will be assessed by comparing original and duplicate results, where applicable. The RPD will be calculated for each pair of applicable duplicate analyses using the following equation:

$$RelativePercentDifference = |S-D|/((S+D)/2)\times 100$$

Where S = First sample value (original value); and
D = Second sample value (duplicate value).

Precision of reported results is a function of inherent field-related variability plus laboratory analytical variability depending on the type of QC sample. Data will be evaluated for precision using field duplicates. The acceptable RPD limits for field duplicates are less than or equal to $\pm$ 20% for aqueous samples. Laboratory measures of precision will be evaluated with appropriate CLP SOW.

Accuracy. Accuracy is the degree of agreement of a measurement with an accepted reference or true value and is a measure of the bias in a system. Accuracy is quantitative and usually expressed as the percent recovery (%R) of a sample result. %R is calculated as follows:

Percent Recovery = SSR - SR / SA x 100

Where:
SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

%R results generated by the laboratory will be evaluated in accordance with the appropriate CLP SOW.

Representativeness. Representativeness expresses the degree to which sample data accurately and precisely represent:

- the characteristic being measured;
- parameter variations at a sampling point; and/or
- an environmental condition.

Representativeness is a qualitative and quantitative parameter that is most concerned with the proper sampling design and the absence of cross-contamination of samples. Acceptable representativeness will be achieved through (a) careful, informed selection of sampling sites, (b) selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter reporting limits, (c) proper gathering and handling of samples to avoid interferences and prevent contamination and loss, and (d) collection of a sufficient number of samples to allow characterization. The representativeness will be assessed qualitatively by reviewing the sampling and analytical procedures and quantitatively by reviewing the blank samples. If an analyte is detected in a method, preparation, or rinsate blank, any associated positive result less than five times (10 times for common laboratory contaminants) the concentration found in the associated blank should be qualified with a "B".

Completeness. Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Usability will be determined by evaluation of the PARCC parameters excluding completeness. Those data that are validated or evaluated and are not considered estimated or are qualified as estimated or non-detect are considered usable. Rejected data are not considered usable. A completeness goal of 90% is projected. If this goal is not met, the effect of not meeting this goal will be discussed by the CDM Federal Project Manager and the EPA RPM.

Completeness is calculated using the following equation:

$$\%Completeness = (DO/DP) \times 100$$

Where: DO = Data Obtained and usable.
DP = Data Planned to be obtained.

Comparability. Comparability is a qualitative parameter. Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Data developed under this investigation will be collected and analyzed using standard EPA analytical methods and QC to ensure comparability of results with other analyses performed in a similar manner.

5.4.2.3 Field Measurements

Several field measurements will be collected during the completion of this RI. Screening level CPT groundwater samples will be analyzed in the field by an onsite mobile laboratory for PCE, TCE, and cis- and trans-1,2-DCE. The onsite mobile laboratory will utilize SW-846 Method 8010 Modified or equivalent to achieve at a minimum the EPA MCL as listed in the EPA Drinking Water Regulations and Health Advisories for the abovementioned contaminants. The ultimate goal is to achieve the minimum screening levels as defined in either the EPA Drinking Water Regulations and Health Advisories, or the EPA Region III RBCs for tap water. The limitations of the mobile laboratory's analytical methods will determine the achievable CPT groundwater analytical goals. Table 5-1 lists the screening goal concentrations for each of CPT groundwater parameter.

The following water quality analyses will be performed in the field from groundwater samples collected from the new and existing monitoring wells:

Alkalinity	Dissolved CO_2
Chloride	Dissolved Oxygen
Oxidation Reduction Potential (ORP)	Temperature
pH	Specific Conductivity
Turbidity	Fe^{+3}/Fe^{+2}
Sulfate	

Note that dissolved oxygen will be collected from the well before purging activities, and will not be collected continuously while purging. The quantitation limits for the natural attenuation parameters will based on the field instruments used to record the information. During sampling activities organic vapor and explosive limits will be collected for health and safety monitoring purposes

5.4.2.4 Laboratory Analysis

Analytical methods, reporting limits, holding times, and QC analyses are discussed below for all samples and media. Table 5-2 provides a summary of this information.

The selected analytical methods for the groundwater sampling will have the quantitation limits as defined in USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Low Concentration Water, OLC02.1, for volatile organics only, USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, OLM04.2, for the remainder of the organic analyses, and USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, ILM04.0. These quantitation limits will provide information to determine the boundaries of the PCE contaminated groundwater plume, and will support the human health risk assessment.

The quantitation limits for the natural attenuation parameters analyzed at the CLP laboratory will be in accordance with the specified methods listed on Table 5-2. The routine detection levels should be sufficient for the screening level risk assessments. If additional investigations are required, the quantitation limits for the compounds of concern will be evaluated to insure that the quantitation limits will meet the risk based DQO's. If required, more sensitive methods or analytical clean-up methods will be used.

Analytical Methods

Groundwater samples will be analyzed for full TCL organics by both the CLP SOW for Organics Analysis, Low Concentration Water, OLC02.1, for volatile organics only, and CLP SOW OLM04.2, for SVOC and Pest/PCB analyses. The samples will also be analyzed for TAL inorganics and cyanide via CLP SOW for Inorganics Analysis, Multi-Media, Multi-Concentration, ILM04.0. Natural attenuation methods are listed on Table 5-2.

Laboratories

Presently, it is anticipated that screening level analytical work will be performed by an onsite mobile laboratory and the remaining analytical work will be performed through EPA's CLP program.

Holding Times

Holding times are storage times allowed between sample collection and sample extraction or analysis (depending on whether the holding time is an extraction or analytical holding time) when the designated preservation and storage techniques are employed. The holding time for the various analytical methods listed for this investigation are presented in Table 5-2.

Quality Control Analyses

To provide an external check of the quality of the field procedures and laboratory analyses, four types of QC samples (duplicate samples, equipment rinsate blanks, field blanks, and trip blanks) will be collected and analyzed. Blank samples will be analyzed to check for cross-contamination during shipping (trip), handling (field) and/or decontamination (rinsate). Duplicate samples provide a check for sampling and analytical error. The samples that will be analyzed for QC are discussed in Section 3, the Field Sampling Plan. To confirm the quality of the water used, at least one sample of the tap water used for decontamination and one sample of analyte free water used for the blanks will sent for analysis. In addition, temperature blanks will be placed in every cooler and checked to determine if the analytical samples were cooled to 4 degrees Celsius. CDM Federal will provide extra sample volume for QA/QC requirements as requested by the onsite mobile laboratory.

5.5 SPECIAL TRAINING REQUIREMENTS

The only special training required for this investigation is the health and safety training, as described in the HASP (Appendix C) and the EPA FORMS II Lite training (if used) for the completion of sample documentation and shipping records.

5.6 DOCUMENTATION AND RECORDS

The laboratories will submit analytical data reports to CDM Federal. Each data report will contain a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The data report will also include signed chain-of-custody forms, cooler receipt forms, analytical data, a QC package, and raw data.

The onsite mobile laboratory will be required to submit a QA/QC plan to CDM Federal for review and approval prior to onset of CPT groundwater sample collection.

6.0 MEASUREMENT AND DATA ACQUISITION

This section covers sample process design, sampling methods requirements, handling and custody, analytical methods, QC, equipment maintenance, instrument calibration, supply acceptance, nondirect measurements, and data management.

6.1 SAMPLE PROCESS DESIGN

The general goal of the field investigation is to verify and quantify the presence or absence of contamination in the sampling media. The number, types, locations, and analyses of samples are presented in Section 3.0 of the FSP.

6.2 SAMPLING METHODS REQUIREMENTS

Sampling equipment, containers, and overall field management are described below.

6.2.1 SAMPLING EQUIPMENT AND PREPARATION

Sampling equipment required for the field program for environmental monitoring, sampling, health and safety monitoring, equipment and personal decontamination, and general field operations are presented in Table 4-1 of the FSP.

Field preparatory activities include review of TSOPs, procurement of field equipment, laboratory coordination, confirmation of site access, as well as field planning meetings attended by field personnel and QA staff. Site setup is described in Section 4.0 of the FSP.

6.2.2 SAMPLE CONTAINERS

Various types of sample containers will be used for the different analyses required on this investigation. The container types and required preservatives for the water samples are provided in Table 5-2. Containers and preservatives will be supplied by CDM Federal. Specialty analytical methods being completed by laboratories outside the CLP program may require pre-preserved glassware supplied by the laboratories.

6.2.3 SAMPLE COLLECTION, HANDLING, AND SHIPMENT

Samples collected during this field program consist of groundwater and QC samples. All sample collection procedures are outlined in the FSP and/or CDM Federal's Technical Standard Operating Procedures Manual (CDM Federal 1999). The following TSOPs (provided in Appendix A) apply to all applicable procedures unless otherwise noted in the FSP:

CDM Federal TSOPs:

- TSOP 1-2, Sample Custody;
- TSOP 1-5, Groundwater Sampling;
- TSOP 1-6, Water Level Measurement;
- TSOP 1-10, Field Measurement of Organic Vapors;
- TSOP 2-5, Packaging and Shipping of Environmental Samples;
- TSOP 2-6, Guide to Handling of Investigation-Derived Waste;
- TSOP 3-2, Topography Survey;
- TSOP 3-5, Lithologic Logging;
- TSOP 4-1, Field Logbook Content and Control;
- TSOP 4-2, Photographic Documentation of Field Activities;
- TSOP 4-3, Well Development and Purging;
- TSOP 4-4, Design and Installation of Monitoring Wells;

- TSOP 4-5, Field Equipment Decontamination at Nonradioactive Sites; and
- TSOP 5-1, Control of Measurement and Test Equipment.

Other SOPs

- SOP 1.0, CPT Groundwater Sampling Procedures

6.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Custody and documentation requirements for field work are described below, followed by a discussion of corrections to documentation.

6.3.1 FIELD SAMPLE CUSTODY AND DOCUMENTATION

The purpose and description of the sample label and the chain-of-custody record are detailed in the following sections.

6.3.1.1 Sample Labeling and Identification

An alpha-numeric coding system will uniquely identify each sample collected during the field investigation. These numbers will serve to identify the sample location, type of sample, sampling round, and fiscal year collected. For CLP samples, the CDM Federal number will serve as the station location number and will be used with the CLP sample number to identify specific samples. For samples that will not be analyzed through the CLP, the CDM Federal number will serve as the sample number. The following paragraphs apply for all sample types except trip blanks and temperature blanks.

Cone Penetrometer Sampling

A template for the CPT groundwater sampling is as follows:

AA-BCC-DDE

Where AA indicates the type of sampling (CP), B is the transect designated by a single letter, CC indicates the sample location along the transect, DD indicates the depth of the sample, and E indicates if it is a duplicate sample which is designated by the letter "P".

Therefore, example identifier CP-E02-80 indicates that this is a cone penetrometer sample collected from transect "E" location 02 at a depth of 80 feet. Example identifier CP-E03-90P indicates that this is a cone penetrometer sample collected from transect "E" location 03 at a depth of 90 feet, and that it was a duplicate sample.

Monitoring Well Samples

A template identification code for monitoring well samples is as follows:

AAAAAA-DDEF

Where AAAAAA indicates the monitoring well number or name, DD indicates the year the sample was collected, E indicates the quarter or sampling round the sample was collected, and F indicates if it is a duplicate sample which is designated by the letter "P" or a resample designated by the letter "R". For new monitoring wells, the well number will be followed by a letter to indicate the well screen interval, "A" for overburden, "B" for top of bedrock, and "C" for bedrock.

Therefore, example sample identifier VC12-00A indicates that this sample was collected from the city of Vienna well number 12 during the first round of fiscal year 2000; whereas, VC12-00BP indicates that this is a duplicate sample that was collected from the city of Vienna well number 12 during the second round of fiscal year 2000. VC12-00BR indicates a re-sampling from the city of Vienna monitoring well.

QC Samples

QC samples will be identified with a different code than environmental samples. A template identification code for trip blank and source water blank QC samples is as follows:

AA-BBBBBB

Where AA indicates the type of QC sample and BBBBBB indicates the date, as explained below.

- A two letter designation (AA) will be used to identify the specific type of QC sample being collected. The QC sample types that follow this code which will be collected during the investigation include but are not limited to the following:

  TB - Trip Blank
  TW - Tap Water Blank
  DI - High Purity Water Blank

- The date (BBBBBB) will be used as the unique identifier. This number will start with the month 01 for January, followed by the date 16, with the year last 01.

Therefore, example sample identifier TB-011701 indicates that it is a trip blank collected on January 17, 2001. Whereas, DI-030101 indicates that it is a field blank from a batch of high purity water collected on March 1, 2001.

Rinsate Blanks

A template identification code for equipment rinsate blank QC samples is as follows:

AABB-CCCCCC

Where AA indicates the rinsate QC sample, BB indicates the type of rinsate blank, and CCCCCC indicates the date as explained below.

- A two letter designation (AA) will be used to identify that the sample is a rinsate blank. This designation will be "RB" for all rinsate blanks.

- A two letter designation (BB) will be used to identify the type of sampling equipment that the rinsate is collected from.
  - CP - Cone Penetrometer Groundwater Sampling
  - GW - Groundwater Sampling.

Therefore, example sample identifier RBGW-011701 indicates that it is a rinseate blank for groundwater sampling collected on January 17, 2001.

6.3.1.2 CLP Paperwork Requirements

Paperwork requirements for shipping environmental samples to CLP laboratories are provided below. All paperwork will be completed by hand or by using the new automated FORMS II Lite Software from EPA. The following requirements are described: CLP Traffic Report/Chain of Custody, Shipping Logs, CLP sample numbers, sample tags, EPA custody seals, and communication of shipping information.

CLP Traffic Report/Chain of Custody

Customized Traffic Reports and Chain of Custody Forms prepared using the FORMS II Lite software will meet the specific laboratory system being used for the various analyses (i.e. CLP, DAS, or outside laboratory program). These forms will be used for all samples shipped from the site. An example form is presented in Appendix D. The following items should be considered when completing the forms:

- Multiple copies of the forms will be printed for distribution. The copies should be distributed to the following groups: RSCC, CLASS, and the laboratory.
- Environmental samples must be designated by a dash (-) in the "field QC" column.
- The MS/MSD is considered lab QC, not field QC. Do not enter MS/MSD information in the column used to designate field QC.
- A temperature blank must be included in every cooler being shipped and be labeled "Temperature Indicator." It must also be listed on the Chain of Custody under Section F, "Tag Number."

CLP Sample Numbers and Labels

The FORMS II Lite software will generates unique CLP sample numbers that will be assigned to each sample. The CLP sample numbers are printed on adhesive labels which are affixed to sample bottles prior to shipment. Sample numbers will be automatically assigned to the Chain of Custody/Traffic Report through the use of the software by the sampler or field team leader.

Sample Tags

A sample tag will be completed and attached to each sample container. Sample tags will be created using the FORMS II Lite software. Any voided sample tags will be retained in the project file.

EPA Custody Seals

At least two custody seals will be placed across cooler openings in such a way that the seals will be broken when the cooler is opened. The sampler or field team leader will sign and date custody seals. Custody seals should not be placed on the lids of sample containers.

Communicating Shipping Information

The field team leader or designee will notify the CLASS coordinator of all sample shipments. The following information will be provided:

- case number;
- name of laboratory;
- date of shipment;
- overnight carrier and airbill number;
- number and matrices of samples shipped;
- case status; and
- sampler's name and phone number.

6.3.1.3 **Sample Packaging and Shipping**

Samples will be packaged and shipped in accordance with TSOP 2-5, Packaging and Shipping of Environmental Samples (Appendix A).

6.3.1.4 **Field Logbook(s) and Records**

Field logbook(s) will be maintained by the field team in accordance with TSOP 4-1, Field Logbook Content and Control (Appendix A). The Field Team Leader is responsible for maintenance and document control of the field logbooks.

6.3.1.5 Photographs

Field teams may photograph appropriate field work activities for documentation purposes. Photographs will be documented in accordance with TSOP 4-2, Photographic Documentation of Field Activities.

6.3.2 CORRECTIONS TO AND DEVIATIONS FROM DOCUMENTATION

Logbook modification requirements are described in TSOP 4-1, Field Logbook and Control (Appendix A). For the logbooks, a single strikeout initialed and dated is required for documentation changes. The correct information should be entered in close proximity to the erroneous entry. All deviations from the guiding documents will be recorded in the logbook(s). Any major deviations will be documented according to the QMP.

6.4 FIELD QUALITY CONTROL SAMPLES

CDM Federal will submit field duplicates to the onsite mobile laboratory. The following types of QC samples will be collected in the field and shipped to the appropriate CLP laboratory for analysis:

- Field duplicates;
- equipment rinsate blanks;
- source blanks; and
- trip blanks.

These types of QC samples are discussed below.

6.4.1 FIELD DUPLICATES

Field duplicates will be collected at a single sampling location, collected identically and consecutively over a minimum period of time. This type of field duplicate measures the total system variability (field and laboratory variance). Field duplicates will be collected at a minimum frequency of one per 20 samples (5%) or one per day, whichever is most frequent.

6.4.2 EQUIPMENT RINSATE BLANKS

If equipment is decontaminated between sampling locations an equipment rinsate blank will be prepared and submitted for analysis at a minimum frequency of one per 20 samples per medium (5%) or one per day, whichever is most frequent. These blanks will consist of analyte-free water poured over the equipment used to collect the sample after equipment decontamination. It is presently anticipated that equipment rinsate blanks will be required for groundwater samples.

6.4.3 SOURCE BLANKS

Source blanks will be prepared and submitted for analysis at least once per month or one per batch of high purity water during field sampling events. Field blanks are prepared by transferring source tap water or source analyte-free water used in the decontamination process into sample containers with appropriate preservatives added. These samples are used to document the condition of the source water used in equipment decontamination. The field blanks will be exposed to the same site conditions as other environmental samples.

6.4.4 TRIP BLANKS

A trip blank consists of analyte-free water poured into a sampling container with appropriate preservatives added. It accompanies the samples through shipment. This QC sample serves as a check for cross-contamination of VOCs during shipment to the laboratory. Once filled, trip blanks must not be opened. A trip blank will be included in each sample shipping container with samples to be analyzed for VOCs.

6.4.5 LABORATORY QUALITY CONTROL

Additional volume will be collected for laboratory QC (MS/MSD) for aqueous samples. Triple volume will be collected for the organic MS/MSD analyses and double volume will be collected for the inorganic MS/MSD analyses.

6.5 INTERNAL QUALITY CONTROL CHECKS

All project deliverables will receive technical and QA reviews prior to being issued to the client, if required. These reviews will be conducted in accordance with Quality Procedure (QP) 3.2 Technical Document Review and QP 3.3 Quality Assurance Review (CDM Federal 1997b). Review forms will be maintained in the project file.

6.6 FIELD INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

Field instruments and equipment will be used to obtain the following water quality parameters:

Alkalinity	Dissolved CO_2
Chloride	Dissolved Oxygen
Oxidation Reduction Potential (ORP)	Temperature
pH	Specific Conductivity
Turbidity	Fe^{+3}/Fe^{+2}
Sulfate	

The field instruments will be calibrated using the method and frequency recommended by the manufacturer. A calibration verification will be performed occasionally on the field screening instruments to ensure proper operation. Specifically to the PIDs, those instruments will be field-calibrated in the morning prior to the days field activities and then a calibration verification check will be performed at the end of the work day (typically approximately 12 hours).

Calibration information will be recorded on calibration forms (included in Appendix B) and field verifications will be recorded in the logbook.

6.7 ACCEPTANCE REQUIREMENTS FOR SUPPLIES

Prior to acceptance, all supplies and consumables will be inspected to ensure that they are in satisfactory condition and free of defects.

6.8 NONDIRECT MEASUREMENT DATA ACQUISITION REQUIREMENTS

Nondirect measurement data include information from site reconnaissances, literature searches, and interviews. The acceptance criteria for such data include a review by someone other than the author. Any measurement data included in information obtained from the above-referenced sources will determine further action at the Vienna PCE site only to the extent that those data can be verified.

6.9 DATA MANAGEMENT

Sample results and QC data will be delivered to CDM Federal as a hard-copied data package. In accordance with the Work Plan for this Work Assignment, Data Usability Reports will be delivered to EPA 7 days after validated data is received. Electronic copies of all project deliverables, including graphics, are maintained by project number. Electronic files are routinely backed up and archived.

CDM Federal's local administrative staff has the responsibility for maintaining the document control system. This system includes a document inventory procedure and a filing system. Project personnel are responsible for project documents in their possession while working on a particular task. Data management protocol and procedures are discussed in Section 4.0.

7.0 ASSESSMENT AND OVERSIGHT

Assessments and oversight reports to management are discussed below.

7.1 ASSESSMENTS AND RESPONSE ACTIONS

The RAC III QA program includes both self-assessments and independent assessments as checks on quality of data generated on this work assignment. Self-assessments include management systems reviews, trend analyses, calculation checking, data validation, and technical reviews. Independent assessments include office, field, and laboratory audits and performance audits.

The QMP requires that office audits be performed once per year for each Work Assignment, and that one field audit be performed for every five weeks of field work that involve sample collection. However, on this Work Assignment, EPA has approved the replacement of office audits with self-assessments. Additionally, one field audit will be performed under this Work Assignment.

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the field logbook and verbally reported to the CDM Federal Project Manager. Major response actions taken in the field will be approved by the CDM Federal Project Manager and the EPA RPM prior to implementation of the change. Corrective action will be implemented in accordance with CDM Federal's Quality Procedure 8.1 Corrective Action (CDM Federal 1997b). A copy of the Corrective Action Request Form is included in Appendix B.

7.2 REPORTS TO MANAGEMENT

QA reports will be provided to management whenever major quality problems are encountered. Field staff will note any quality problems in a logbook or other form of documentation. CDM

Federal's Project Manager will inform the QA Coordinator upon encountering quality issues that cannot be immediately corrected.

8.0 DATA VALIDATION AND USABILITY

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed in Sections 8.1 and 8.2, respectively.

8.1 VALIDATION PROCESSES

As discussed previously, samples will be analyzed either by OASQA or through the CLP or DAS programs. Validation of all CLP and DAS data will be completed by EPA's ESAT contractor in accordance with the most recent functional guidelines. Levels IM2 and M3 are recommended for this project, because it is an RI/FS. Validation processes for each of these mechanisms are discussed below.

8.2 DATA EVALUATION

One hundred percent of the analytical data will be evaluated for compliance with PARCC parameter criteria as described in Section 5.0. After validation and evaluation, it will be determined by CDM Federal if and which data are usable for their intended purposes.

Mobile laboratory data will be evaluated by CDM Federal. CDM Federal will ensure that the mobile laboratory adheres to their QA/QC plan which will be reviewed and approved by CDM Federal prior to CPT groundwater sampling. CDM Federal will review method blanks, duplicates, check standards, and calibration standards as referenced in the mobile laboratory's QA/QC plan.

PART III: DATA MANAGEMENT PLAN

9.0 DATA MANAGEMENT PLAN

This Data Management Plan (DMP) has been prepared to describe how CDM Federal will manage, manipulate, and present data collected during the RI. This plan covers all RI data including fixed-based laboratory results, field screening results, and other field data.

9.1 DATA ASSEMBLY

Data collected during the field investigation will be organized, formatted, and inputted into the database for use in the data evaluation phase.

CDM Federal assumes that all CLP data will be validated by the EPA Region III Environmental Services Assistance Team (ESAT) or by the EPA Region III OASQA in accordance with all EPA Region III Functional Guidelines.

CDM Federal will use EarthSoft's EQuIS Data Management System (EQuIS) and Microsoft's Excel spreadsheet software for managing all data collected during the sampling program. This software is a full-featured environmental data management system designed for both geological and analytical data management. EQuIS enables the user to organize, manage, import, export, analyze, and model:

- scheduled and ad hoc sampling and analysis events well and boring installation and construction features
- well and sampling locations
- water-level measurements
- testing methods
- analytical parameters and results

EQuIS will provide data storage, retrieval, and analysis capabilities, and is able to interface with a variety of spreadsheets, word processing, statistical, and graphics software packages.

9.2 DATA ENTRY AND FORMAT

CDM Federal will provide to the laboratory (ies) contracted through EPA's CLP a detailed format specification in Microsoft Excel and directions explaining the template (see Appendix D) for the delivery of analytical data in an electronic data deliverable (EDD). This will provide CDM Federal the data in a format compatible with CDM Federal's data management system. However, sometimes additional pre-processing of the electronic data is required to prepare the laboratory data into a electronic format readable by EQuIS. Any effort of electronic importing will be compared to the task of manual data entry and discussed with the EPA Work Assignment Manager (WAM.) If the laboratory is unable to provide the raw data in electronic format, then validated data will be hand entered into EQuIS.

Sample data will be uploaded and entered by CDM Federal. A printout of the file will be generated for CDM Federal Data Management staff to prepare a data QA/QC report. CDM Federal will perform a QA review of the file for data entry errors and uploading problems.

Data managed by this system will include fixed-based laboratory results, field screening data, and other field data including:

- Soil boring and monitoring well logs;
- Field sampling data;
- Hydrogeological testing data;
- Air sampling data; and
- CPT groundwater sampling data.

An Access database will be assembled to print appropriate labels for sample bottleware. The database will also track samples and their expected analysis. This information will be imported into EquIS to eliminate double manual entry.

9.3 DATA USEABILITY EVALUATION

Upon receipt of validated EPA data, CDM Federal will review the data and the data validation report to determine if the data are of sufficient quality to be relied upon in performing the risk assessment, preparing the feasibility study, and supporting the Record of Decision (ROD). The review will include an evaluation of field quality assurance/quality control (QA/QC) requirements to determine whether the samples were collected at the frequency specified in the Quality Assurance Project Plan (QAPP) and whether the results of the QA/QC samples are within specific guidelines. The review will also include an evaluation of the data validation report conclusions concerning whether the data meets the established quality goals.

9.4 DISKETTE HANDLING

The database will be maintained on a fixed hard drive, and the data will be archived on ZIP disks. The label on archival diskette and the transferred diskettes will include the following: client, work assignment number, diskette number, date of origin, and format of data files. CDM Federal will maintain a log of all the database files and diskettes that will track information and the status of each diskette. This log will also provide assurance that the database has been backed up weekly.

9.5 QUALITY ASSURANCE AND QUALITY CONTROL

A printout of the database file will be generated and provided to the CDM Federal data management staff for QA/QC purposes and for the preparation of the Data QC Report. The electronically available data will be transferred into the project database and a 10% QA check will be performed by the CDM Federal data management staff. A 100% QA check will be performed on the information that has required manual data entry by the CDM Federal data management staff. The database has internal validation checks to verify that the type of information in each field is a valid entry and that the required information has been entered.

9.6 RETRIEVAL AND DATA ANALYSIS CAPABILITIES

Using the EQUIS database system, data are easily retrievable. Tables of analytical results will be organized in a logical manner such as by sample location number, sampling zone, or some other logical format. Data tables comparing the results of various phases of sampling efforts will be prepared and evaluated. CDM Federal will coordinate the table organization with the EPA WAM. Examples of data analysis capabilities include generation of:

- Hits tables
- Comparison to Maximum Contaminant Levels or Risk-Based Concentrations

Data can also be exported for use in the risk assessment standard tables.

9.7 GRAPHIC SOFTWARE PACKAGES

Analytical data results will interface with graphics packages to illustrate contaminants detected. Graphic illustrations in the RI report will include geologic profiles, cross-sections, contaminant isoconcentration maps, and longitudinal and cross-sectional profiles of groundwater and soil contamination.

EQuIS has excellent compatibility with:

- EXCEL, a common spreadsheet, data analysis, and presentation application
- ArcView, a powerful geographic information system application and display tool

- Surfer, a widely used application for plotting spatial data and generating post, contour, and surface plots
- gINT, an integrated database and report generator designed for subsurface data, including boring logs, monitoring well construction details, and geologic cross-sections

CDM Federal also successfully integrated data among various databases and also exported this data into other additional formats including AutoCad and Microstation.

Examples of client deliverables include crosstab reports showing all analytical data and/or comparing the data to standards; CADD maps; groundwater modeling; graphics; and electronic media to contain the final analytical data in a format specified by the client. Examples of internal data requirements are statistical reports for subsequent phases of the project (e.g., risk assessment); variations of the crosstab reports (hit tables); data exported to other software applications for mapping, graphing, or modeling; and reports to track the data management effort.

PART IV: POLLUTION CONTROL AND MITIGATION PLAN

10.0 POLLUTION CONTROL AND MITIGATION PLAN

The purpose of this Pollution Control and Mitigation Plan is to outline the procedures that will be taken to ensure that contaminants are not released off-site during remedial investigation activities for the Site. This plan will detail procedures for the following:

- Ensuring that contaminants are not mobilized or released by sampling activities
- The handling of investigation-derived wastes (IDW) to include storage, treatment, and disposal

The remedial investigation field activities will generate IDW that are defined as discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or nonhazardous. Every effort will be made to minimize the amount of IDWs.

IDW from the field investigation phases will be disposed in accordance with all applicable RCRA and Toxic Substance Control Act (TSCA) regulations by a waste removal/disposal firm under subcontract to CDM Federal. All activities will follow the EPA guidance document, *Guide to Management of Investigation-Derived Wastes, 9345-03FS, January 1992.* In addition, the CDM Federal Site Manager will ensure that all sampling wastes are handled in accordance with CDM Federal TSOP 2-6, Guide to Handling Investigation-Derived Wastes, provided in Appendix A.

IDW may include drill cuttings, tubing, plastic sheeting, personal protective equipment, purge water, and decontamination water. These waste will be placed in Department of Transportation

(DOT) approved drums, roll-off containers (for solids), and/or tanks with secondary containment (for liquids). All drums, tanks, or containers will be labeled and dated for storage prior to testing and disposal. CDM Federal will prepare a detailed scope of work as part of the process to procure a waste removal subcontractor.

11.0 REFERENCES

CDM Federal Programs Corporation, 1996. Quality Management Plan. December.

CDM Federal Programs Corporation, 1997a. Quality Assurance Project Plan. September.

CDM Federal Programs Corporation, 1997b. Quality Assurance Manual, Part Two, Revision 8, October.

CDM Federal Programs Corporation, 1999. Technical Standard Operating Procedures Manual, Revision 12. April.

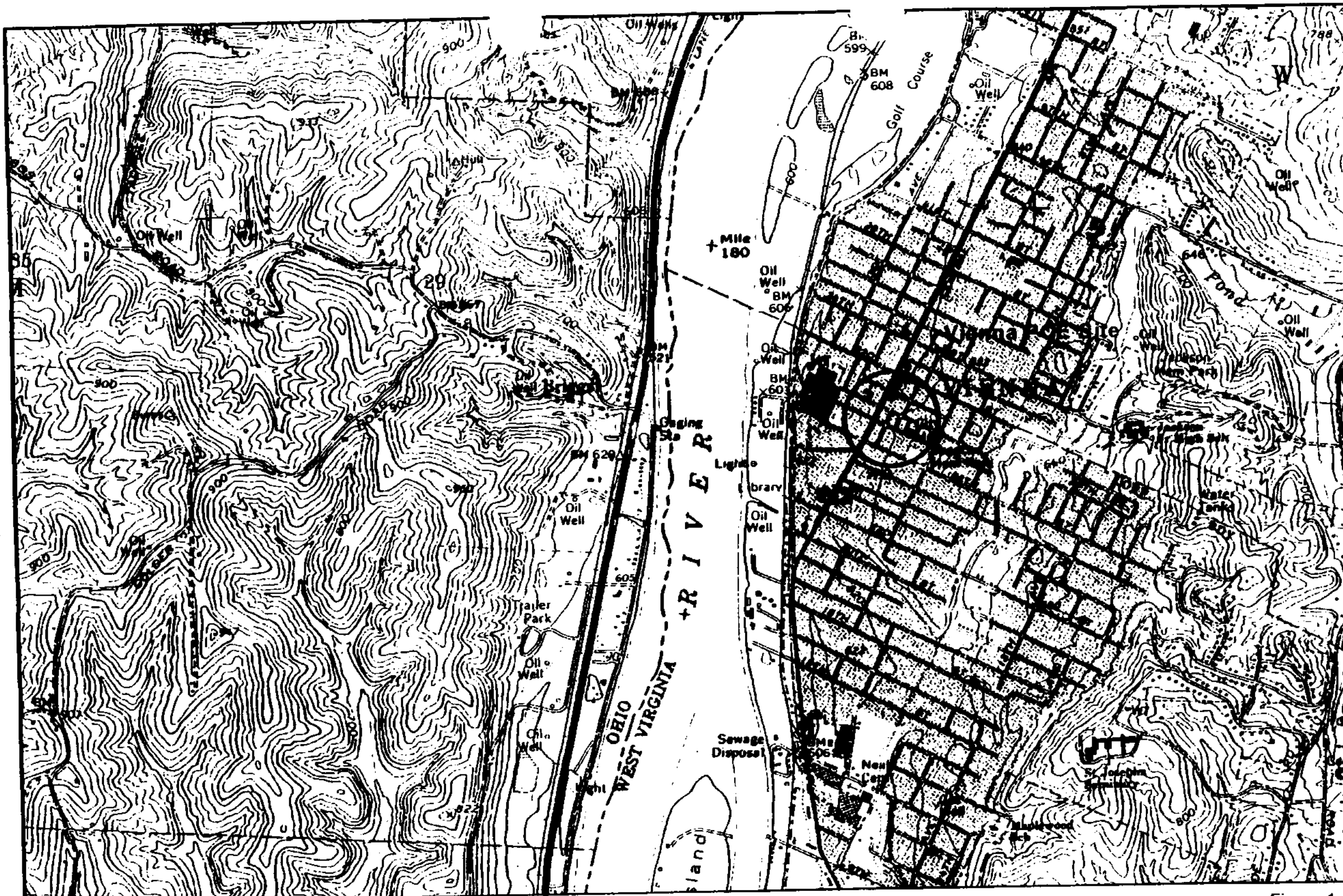
ERTC/Roy F. Weston Inc., 1997. Preliminary Report, Vienna Wellfield Site, Evaluation of PCE Groundwater Concentrations, Source Strength and Remedial Options. December.

REAC/Roy F. Weston Inc., 1994. Final Report–Site Assessment of Vienna Well Field Site, Vienna, Wood County, West Virginia. Volumes 1 & 3. May.

U.S. Environmental Protection Agency (EPA). 1994. Guidance for the Data Quality Objectives Process, EPA QA/G-4. September.

U.S. Environmental Protection Agency (EPA). 1997. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, QA/R-5. Draft Final, October.

FIGURES



N

Not to Scale

Figure 1
Site Location
Vienna PCE Site
Remedial Investigation
Vienna, WV

CDM Federal Programs Corporation

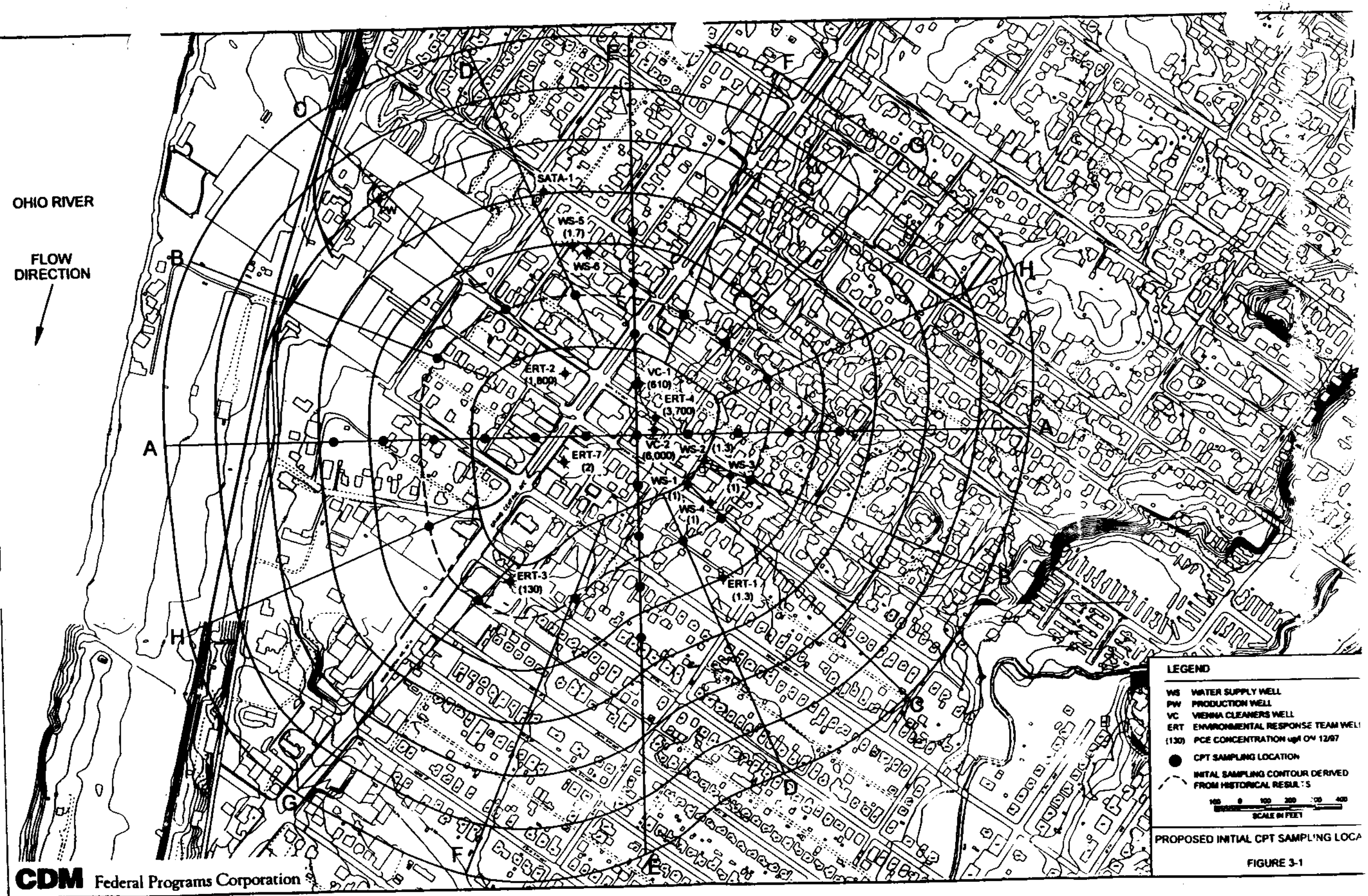
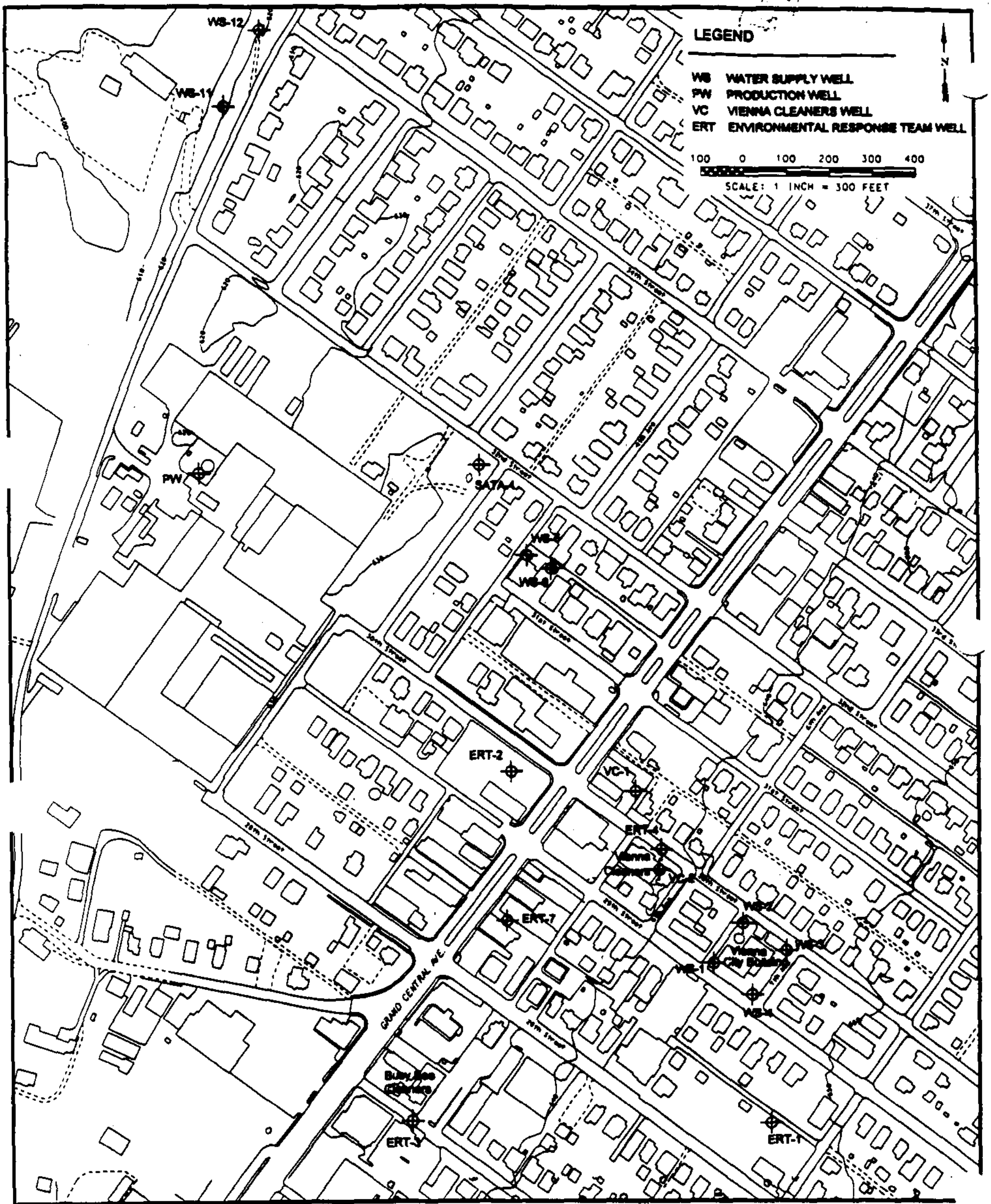


FIGURE 3-1

CDM Federal Programs Corporation

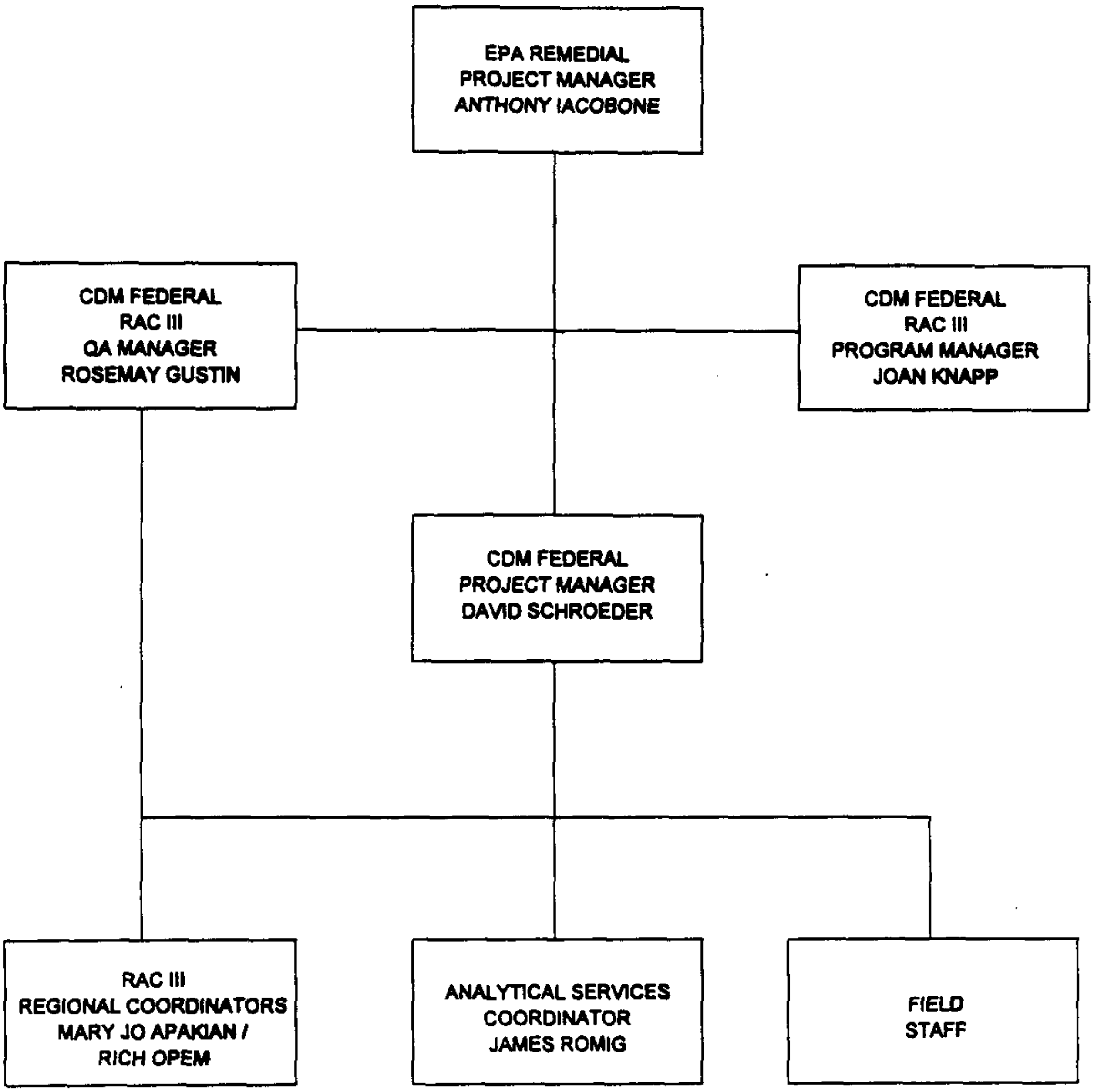


CDM Federal Programs Corporation

WELL LOCATION MAP
VIENNA PCE SITE
VIENNA WEST VIRGINIA

FIGURE
2-1

AR300085



CDM Federal Programs Corporation

PROJECT TEAM
ORGANIZATION CHART
VIENNA PCE SITE

FIGURE
5-1

ORIGINAL (Red)

TABLES

TABLE 4-1
FIELD EQUIPMENT, SUPPLIES, AND CONTAINERS

Groundwater Sampling

Sampling
Paper towels
Tape - duct
Tape - *Teflon®*
Conductivity meter calibration fluid
Preservative, HCL
Preservative, HNO_3
Glass, 1L bottle amber Teflon®-lined lid
Glass, 40ml VOA, amber, Teflon® septum
Polyethylene 1L bottle, poly. lid
Polyethylene sheeting, 100ft.
Funnel
Garden hose, 75 ft.
Hand Pump and 0.45 micron filters
Teflon® tubing, 1/4 in. dia.
Downhole DO Meter
Water quality (pH/conductivity/temperature/turbidity/redox/DO) meter
Hach Test Kits (Alkalinity, Diss. CO2, Chloride, Ferrous Iron, Sulfate)
Generator
Peristaltic pump, small head
Submersible pump, 2 in. dia.
Controller box
Water level indicator

Health and Safety
Gloves, cotton, under gloves
Gloves, cotton, work gloves
Gloves, latex
Tyvek, coveralls
Latex, over boots
Rainsuit, PVC
OVA Organic Vapor Meter

General
Camera: 35mm film and developing
Field Logbooks
Garbage bags
Bolt cutters
Extension cords, 100 ft.
Locks, keyed alike.
55 gallon water drums

TABLE 4-2
Existing Monitoring Well Data

Well ID	Diameter	Total Depth	Screen Length and Slot Size	Screen Interval	Depth to Water 5/97	Type	Elevation	
							TOC	Bottom
ERT-1	4" OD	79.32'	20' - 0.010	59.32' to 79.32'	60.6'	Flush mount	639.495	560.2
ERT–2	4" OD	67.50'	20' - 0.010	47.50' to 67.50'	48.39'	Flush mount	634.855	567.4
ERT-3	4" OD	67.87'	20' - 0.010	47.87' to 67.87'	48.49'	Flush mount	634.750	566.9
ERT-4	4" OD	70.83'	20' - 0.010	50.83' to 70.83'	51.58'	Flush mount	638.360	567.5
ERT-5	4" OD	69.22'	20' - 0.010	49.22' to 69.22'	Not Listed	Flush mount	619.238	550.0
ERT-6	4" OD	70.00'	20' - 0.010	50.00' to 70.00'	Not Listed	Flush mount	617.258	547.3
ERT-7	4" OD	80'	25' - 0.020	55' to 80'	49.9'	Flush mount	Not Listed	Not Listed
VC-1	Not Listed	Approx. 100'	Not Listed	Not Listed	50.0'	Not Listed	Not Listed	Not Listed
VC-2	Not Listed	Approx. 100'	Not Listed	Not Listed	51.8'	Not Listed	Not Listed	Not Listed
SATA-1	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed

ORIGINAL (Red)

TABLE 5-2

Groundwater Sampling Requirements and Analytical Methods					
Parameter	Recommended Instrument	Analytical Method	Bottle Req.	Preservative	Holding Time
Field Parameters					
Dissolved Oxygen *(in-situ)*	*Orion 830*	DRI	N/A	N/A	N/A
Eh	*Orion 230A or 290A*	DRI	N/A	N/A	N/A
pH	*overflow or flow-thru cell*	DRI	N/A	N/A	N/A
Specific Conductivity	*overflow or flow-thru cell*	DRI	N/A	N/A	N/A
ORP	*overflow or flow-thru cell*	DRI	N/A	N/A	N/A
Turbidity	*overflow or flow-thru cell*	DRI	N/A	N/A	N/A
Temperature	*overflow or flow-thru cell*	DRI	N/A	N/A	N/A
Ionic Parameters (Onsite Analyses)					
Sulfate	HACH (DR2000 or Similar Colorimetric)	HACH 8051	1-500 mL plastic bottle	Cool 4°C	Same Day
Iron (II)		HACH 8146		Cool 4°C	Same Day
Alkalinity		HACH 8221		Cool 4°C	Same Day
Chloride		HACH 8113		Cool 4°C	Same Day
Carbon Dioxide		HACH 8205 or 8223		Cool 4°C	Same Day
Ionic Parameters/Metals/Gases (Laboratory)					
Nitrate/Nitrite	—	IC Method E 300	1-L Polyethylene	H_2SO_4 Cool 4°C	48 Hours
Methane/Ethane / Ethene[1]	—	SW-846, 8015B	2-40 ml VOA vials	None	7 days
COD	—	EPA 410.1	50 ml	H_2SO_4 Cool 4°C	7 days
BOD	—	EPA 405.1	1 l	Cool 4°C	48 Hours
Organic Parameters (Laboratory)					
Total Organic Carbon	—	EPA 9060	125 ml amber glass	H_2SO_4 Cool 4°C	28 days
Dissolved Organic Carbon	—	EPA 9060	125 ml amber glass	H_2SO_4 Cool 4°C	28 days
Volatile Organics	—	CLP SOW OLM04.2; OLC02.1	3-40 ml VOA vials	HCl, Cool 4°C	14 days
SVOCs	—	CLP SOW OLM04.2; OLC02.1	2 - 2 liter amber glass	Cool 4°C	7 days extraction 40 days analysis
Pest/PCBs	—	CLP SOW OLM04.2; OLC02.1	2 - 2 liter amber glass	Cool 4°C	7 days extraction 40 days analysis

TABLE 4-3

Sampling Requirements and Analytical Methods					
Parameter	**Recommended Instrument**	**Analytical Method**	**Bottle Req.**	**Field Filtered (Y/N)**	**Preservative**
Field Parameters					
Dissolved Oxygen *(in-situ)*	*Orion 830*	DRI	N/A	N	N/A
Eh	*Orion 230A or 290A*	DRI	N/A	N	N/A
pH	*overflow or flow-thru cell*	DRI	N/A	N	N/A
Specific Conductivity	*overflow or flow-thru cell*	DRI	N/A	N	N/A
ORP	*overflow or flow-thru cell*	DRI	N/A	N	N/A
Turbidity	*overflow or flow-thru cell*	DRI	N/A	N	N/A
Temperature	*overflow or flow-thru cell*	DRI	N/A	N	N/A
Ionic Parameters (Onsite Analyses)					
Sulfate	HACH (DR2000 or Similar Colorimetric)	HACH 8051	1-500 mL plastic bottle	Y, if necessary*	Cool 4°C
Iron (II)		HACH 8146		Y, if necessary*	Cool 4°C
Alkalinity		HACH 8221		Y, if necessary*	Cool 4°C
Chloride		HACH 8113		Y, if necessary*	Cool 4°C
Carbon Dioxide		HACH 8205 or 8223		Y*	Cool 4°C
Ionic Parameters/Metals/Gases (Laboratory)					
Nitrate/Nitrite	—	IC Method E 300	1-L Polyethylene	N	H_2SO_4 Cool 4°C
Methane/Ethane / Ethene[1]	—	SW-846, 8015B	2-40 ml VOA vials	N	None
COD					
BOD					
Organic Parameters (Laboratory)					
Total Organic Carbon	—	EPA 9060	125 ml amber glass	N	H_2SO_4 Cool 4°C
Dissolved Organic Carbon	—	EPA 9060	125 ml amber glass	Y*	H_2SO_4 Cool 4°C
Volatile Organics	—	CLP SOW OLM04.2; OLC02.1	3-40 ml VOA vials	N	HCl, Cool 4°C
SVOCs	—	CLP SOW OLM04.2; OLC02.1	2 - 2 liter amber glass	N	Cool 4°C
Pest/PCBs	—	CLP SOW OLM04.2; OLC02.1	2 - 2 liter amber glass	N	Cool 4°C

Sampling Requirements and Analytical Methods					
Parameter	Recommended Instrument	Analytical Method	Bottle Req.	Field Filtered (Y/N)	Preservative
Inorganic Parameters (Laboratory)					
Total Metals and Cyanide	—	CLP SOW ILM04.0	2-L Polyethylene	N	HNO_3 and NaOH, Cool 4°C
Filtered Metals and Cyanide	—	CLP SOW ILM04.0	2-L Polyethylene	Y*	HNO_3 and NaOH, Cool 4°C

N/A – Not applicable
DRI = direct reading instrument
* = Collected with Grundfos Redi-Flo 2 submersible pump with in-line filter

TABLE 5-1
CPT Groundwater Sampling Analytical Goals

Parameter	EPA MCL (µg/l)	Region III RBC* (µg/l)	Analytical Goal (µg/l)
PCE	5	1.1	1.1
TCE	5	1.6	1.6
cis-1,2-DCE	70	610	70
trans-1,2-DCE	100	1,200	100

Notes
* = Tap Water

Groundwater Sampling Requirements and Analytical Methods					
Parameter	**Recommended Instrument**	**Analytical Method**	**Bottle Req.**	**Preservative**	**Holding Time**
Inorganic Parameters (Laboratory)					
Total Metals and Cyanide	—	CLP SOW ILM04.0	2-L Polyethylene	HNO_3 and NaOH, Cool 4°C	Cyanide 14 days, Mercury 28 days, others 180 days
Filtered Metals and Cyanide	—	CLP SOW ILM04.0	2-L Polyethylene	HNO_3 and NaOH, Cool 4°C	Cyanide 14 days, Mercury 28 days, others 180 days

N/A – Not applicable
DRI = direct reading instrument
* = Collected with Grundfos Redi-Flo 2 submersible pump with in-line filter